# The Improvement of Fault Detection in Different Fabric for a Weaving Loom

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**Abstract -** *The inadequate and excess illumines are severe problem in any vision control system especially in fabric fault detection system, it is because different kind of fabrics and different view marks are involved. To overcome these problem, should optimize the light intensity and optimize the threshold level for various fabrics accordingly. This study mainly focused on reducing complexity of automated fault detection system in real time. The important demerits of exiting system for fault detection are necessity of enormous memory, long processing time, strictly stick on a single design and non-adoptability for different kind of fabric materials. There is a necessity to sort out these problems with a simplified system. At this juncture, the developed system sorted out almost all the demerit of the existing system by measuring the intensity of the light, which is passed through the fabric. The escaped lights are captured by a camera and this signal fed into a data acquisition card. Then, the signal is synthesized in the hardware module itself, the signal was processed by various image processing techniques. The operations of developed system are explained. Also the merits and demerits of the developed system are discussed.*

***Key Words*: Fault detection- light intensity-camera- data acquisition- image processing**

## 1. INTRODUCTION

In the modern era, quality and effective production are played a vital role in any industry. There is no exception for the textile industry too. Traditionally the defects of the fabric are identified by a human in the post production process otherwise defects are monitored by skillful labors in running condition .The huge number of skillful labors should be involved in traditional method to produce defect free fabric. There are many research carried out for vision based automated defect detection by various image processing techniques like image filters, various edge operators and neural networks. These types of image processing techniques are yielded better result only for single design especially in plain weave. The accuracy of defect detection system mainly depends on its illumination and position of the camera [1]. The percentage of defect detection success rate has been varied for different methods like mathematical morphology, wavelet transform, Gabor transform method neural networks and direct threshold method [2-6]. The speed of the weaving loom purely depends on the response time of the jacquard machine which is attached with the loom to create various weave marks on the fabric. When the design pattern is complicated, then any individual method of image processing techniques are unable to perform well in the process of fault detection. So, the defect detection system should has a combination of these methods to detect defects in complicated design.

At this juncture, a necessity to invent a system to sorted out these problems in an effective way. This study was carried out on the basis of a novel idea. The novel idea of this study is the intensity of back light which is passed through the various fabric design or view marks on the fabric. The special setup was arranged to measure the intensity, it consists a back light and a camera. When applying complex design to the fault detection system, they were little bit confused in their decision making process whether it is actual design or fault in the fabric. As a result, the percentage of error free fault detection of the system will get reduced significantly. Fabrics are produced not only in plain weaves but also in various view marks for its fancy.

The novel idea behind the study is the prediction of possible weave marks on the fabric. The possible view marks on the fabric are plain weave, satin and sateen. Whatever may be the design whether it is simple design or complex design but they will comes under any one of the above said weave mark. The prediction of the view marks are played a vital role in this work. The intensity of the light received by a camera not only depends on the view marks on the fabric but also depends on the materials which is used for fabric. When light intensities are optimized for various fabric materials then the light intensity received by a camera purely depends on the view mark of the fabric. If any irregularities in their view marks, then the proposed system will easily detect the faults in the fabric with the help of light intensity variation and various threshold levels.

## 2.. EDGE DETECTION WITHOUT LIGHT INTENSITY OPTIMIZATION

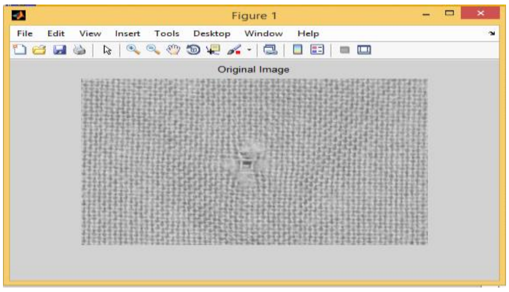
The high accuracy fault detect system was found after various methods had been tried. The methods are Edge detection without light intensity optimization and Edge detection with light intensity optimization for cotton, synthetic and silk. In both methods all the three weave marks had been tried then light intensities were measured, analyzed and concluded.

The physical setup for a fault detection system was arranged on a weaving loom with a camera and suitable back light. The light source is kept under the fabric and the camera is placed on the fabric in an appropriate height. There is no control to vary the intensity of back light, the intensity of back light remains constant for cotton, synthetic and silk. After the arrangements are made perfectly, the defect free images of all the weave mark were captured by the camera. The images are underwent Sobel edge operator, Prewitt edge operator, Roberts edge operator Laplacian of Gaussian and Canny edge operator. The images from edge operators will be displayed. The binary value of the image will be measured by row wise for all three weave marks. By analyzing these binary values we came to know possible set of subsequent high values and low values for error free fabric in each view mark. Once possible set of subsequent binary values (high and low values) found for all weave marks. Then decision making process will be very easy.

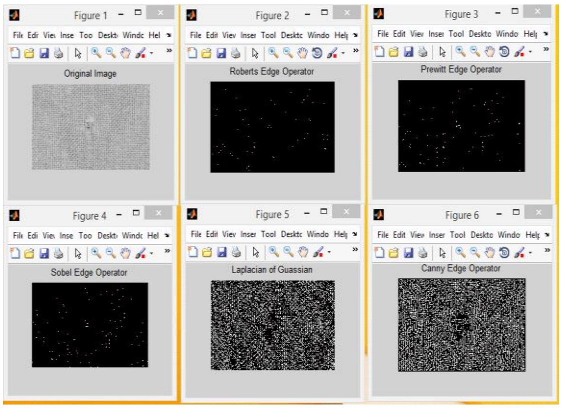
## 3. EDGE DETECTION WITH LIGHT INTENSITY OPTIMIZATION

There is no difference between method I and method II in their physical arrangement but the difference is in control of light intensity in method II. A huge number of defected images and defect free images were processed by various edge operators to optimize light intensity for each fabric material. Optimization is a process to find the critical light intensity which is used to detect fault in the fabric without any error. The optimized light intensities for different materials like cotton, synthetic and silk were found by varying the intensity of back light.

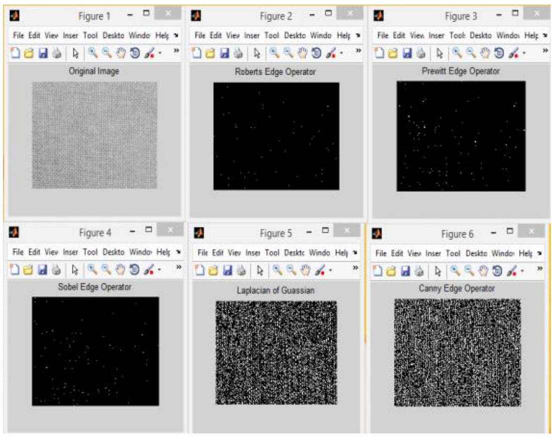
Original image




Damaged result




Not Damaged result




Light intensities are optimized one by one for each materials. In this work three different kind of fabrics were taken. They are cotton, synthetic and silk. The nature of light absorption property of each fabric and the dense of the fabric are the key factors to optimize light intensity.in most of the case, dense of the fabric remains same. According to the absorption co-efficient of the fabric lights were penetrated the fabric and the images were captured by camera for further process. Then the images were underwent image processing techniques to optimize the light intensity.

## 4. EXPERIMENTAL PROCEDURE FOR LIGHT OPTIMIZATION

### 4.1. Fabric Material

First, the light intensity for cotton fabric is optimized at constant dense of fabric and same thickness of fabrics were used over the process. Then penetrated light intensities are captured by the camera as images for each weave mark.

Secondly, the same procedure is followed for synthetic fabric for various view marks. The size of the fabric (256x256) is taken for light optimization. Then penetrated light intensities are captured by the camera as images for each weave mark. Finally, the light intensity is optimized for silk. Whereas the silk is a soft material extra care was taken for optimization.

### 4.2. Weave mark

The most commonly used weave mark to analyze the defect detection system is plain weave mark. It is because the possible subsequent binary values are alternated binary values. If the values are 01010101 and the next row would be 10101010.

When the fault detection system measured the values other than the alternative values, fault will be detected in the fabric. When the system has an idea about satin and sateen weave marks of the fabric, then the percentage of error free detection will be increased significantly. It is because these weave marks are little bit complex than plain weave mark. For example binary value for the satin is 10001000, then the values for sateen is 01110111. In other hand the complement value of satin design will be sateen design. Any fabric taken for fault detection, the fabric would have at least any one of the above said weave mark. By setting threshold value as per view mark on the fabric, the percentage of error free fault detection can be increased remarkably.

## 5. CLASSIFICATION OF FAULTS

Whenever talking about more than one possible faults in a fabric, these fault should be classified in an effective way to give a proper service to the fault. The possible faults in a fabric are missing weft, missing warp ends, hole, overlapping, low pick density, high pick density and so on. These defects are effectively classified successfully.

## VI. RESULT AND DISCUSSION

| Edge Detection | Percentage of error free detection |
|---|---|
| Roberts edge operator | 63.2 |
| Prewitt edge operator | 64.6 |
| Sobel edge operator | 64.8 |
| Laplacian of Gaussian | 71.8 |
| Canny edge operator | 78.1 |

**Table I Comparison of error free percentage**

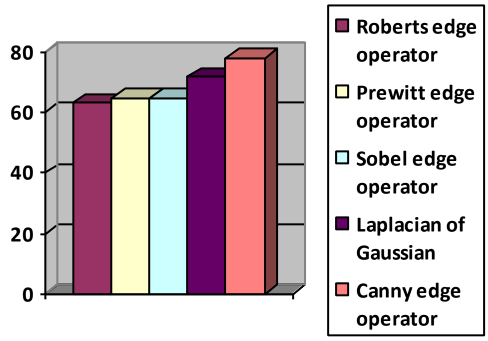



Chart I: **Comparison of edge operators**

The comparison study of method I and method II discussed in detail. Their results are tabulated and interpreted with each other. The optimized light intensities for different kind of fabrics is listed. The percentage of error free detection is calculated for the proposed system and percentage of success rate of the proposed system (light optimized method) is increased at least 2% to 5% than other fabric fault detection system.

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