Image Processing Techniques and its Application in Water Transport through Fabrics

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Abstract: With the development of new synthetic fibres it is significant to study water transport through the fabric. Vertical wicking test is usually used to understand this fabric property. But the method for gaining parameters is still done manually at present. This paper will report an image processing technique on water transport through fabrics. Fabric images during wicking are shot for every 1min in 30mins. Every image can be divided into two areas to indicate fabric dryness and wetness. Finally, the wicking height can be calculated to understand water transport through the fabric. Considering the distortion of the vertical object image size far away from optical axis it is necessary to modify wicking height. Based on the vertical wicking measurement for fabric, the modification method took 300 mm height of the distortion image that was divided by 1 mm. A modifier formula was deduced based on geometry. It can improve the precision of wicking height obtained by image processing techniques. An application example is also described in this paper. Some fabrics were proved to have good water absorbing quality and moisture management. From the curve of the wicking height based on image processing techniques, initial wicking rate can explain the water absorbing quality and the maximum wicking height is used to illustrate moisture management.

Keywords: Image processing, vertical measurement, revising method, moisture absorbable and breathable fabric.

1. Introduction

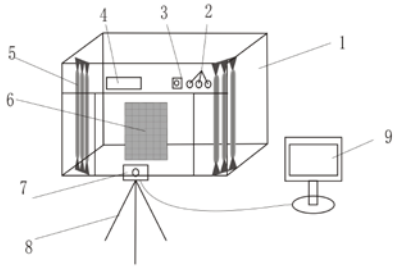
With the development of new synthetic fibres it is significant to study water transport through a fabric. Vertical wicking test is usually used to understand it. But the method for gaining parameters is still done manually at present. Some researchers have tried to improve the scientific and veracity of the test results. Hollies etl. [1] adopted the electrical resistance and conductance to detect the wicking height. Li Yi [2] invented the MMT method（Moisture Management Of Textiles）to get the wicking height; Zhuang Qinliang [3] introduced image processing techniques to the vertical wicking measurement, considering distortion of the vertical object image size far away from optical axis, a stepping motor, which can control the angles of video camera, is used to capture images of liquid frontier. But fabric wicking is not a linear process, stepping motor cannot guarantee consistency between the video camera and liquid frontier.

In this paper, we report a novel image processing technique based on vertical wicking measurement. It can divide the image into two areas to indicate the fabric dryness and wetness clearly. The technique also considers the distortion and proposes a radial distortion modification. The characteristics of moisture absorbable and breathable fabrics, cotton fabrics are studied by this method.

2. Experimental introduction

2.1 Equipment

A schematic diagram of the novel device is shown in Figures 1 and 2. The device consists of image acquisition setting (Figure 1.) which can collect images continuously in every 0.1 seconds, the constant light box vertically placed with three groups luminaire provides a higher uniformity in images of fabric wicking and fabric vertical wicking setting (Figure 2.).



1. Light box; 2. Light box switch knob; 3. Light box switch; 4. Light box panel; 5. Lamp; 6. Vertical wicking setting; 7. CCD camera; 8. Tripod; 9. Computer.

Figure 1 Image acquisition setting.

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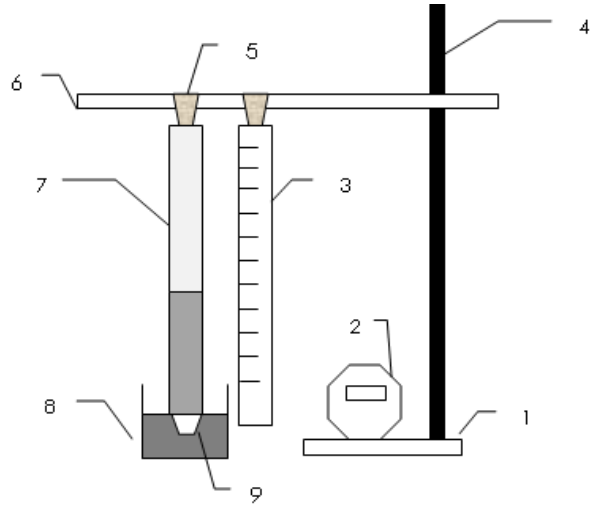

1. Bottom; 2. Stopwatch; 3. Sample; 4. Beam; 5. Sample clip; 6. Vertical bracket; 7. Ruler; 8. Container; 9. Tension clip.

Figure 2 Vertical wicking setting.

3. Image processing technique

3.1 Key technology of image processing

Image processing utilized Matlab technique, the main procedure is shown in Figure 3.

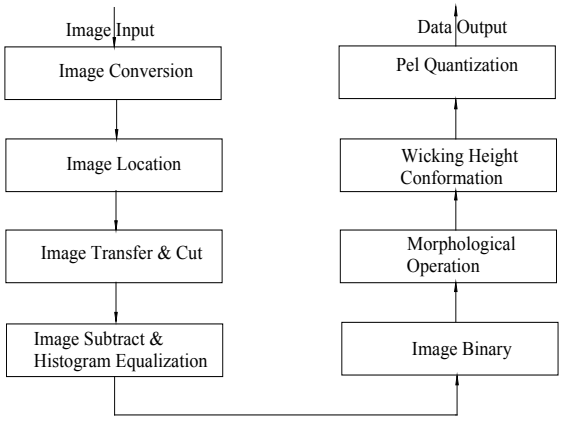

Figure 3 The main procedure.

3.1.1 Image location

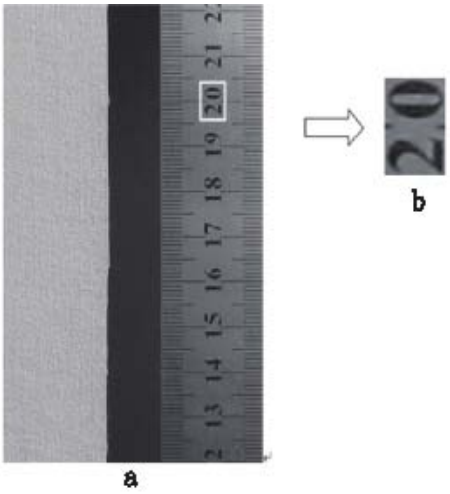

Figure 4 Schematic diagram of image location.

In order to subtract two or more than two images, the same image in area and size were obtained by image location. The 20 cm image of the rule near the fabric sample was chosen as the characteristic sub-image. The schematic diagram is shown in figure 4.

3.1.2 Image subtraction

The tested time of vertical wicking is 30 min, the wicking height is not clear in the later stages. In order to get the wicking height clearly, we used wicking image to subtract the non-wicking image (see Figure 5).

Figure 5 Image subtraction.