# DEVELOPMENT OF FABRIC-PILL SCANNING SYSTEM FOR THE QUALITY ASSESSMENT OF TEXTILE

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## ABSTRACT

*The present design relates to systems and methods for assessment of degree of pilling on fabric surface and more particularly to the architecture and operation of an fabric pilling measurement system based on optical scanner Here the assembly and operation of fabric pilling measurement system has been characterized, which has been assembled from easily available, inexpensive configurable components, majority of which are sourced from common electronic shop. Fabric sample mounted on pill cylinder is rolled on the surface of the flatbed scanner in non-contact way in synchronisation with the scanner sensor-head. Flat image of the pilled fabric sample thus produced further analysed mathematically for the extraction of the pillingextent on the fabric surface.*

***Keywords:*** *Pilling, fabric surface, optical scanner, pilling, architecture.*

## 1. Introduction

During manufacture, use and storage, cloth is constantly subjected to friction against itself or objects in its surroundings. Textile fibres and structures are mal affected along time due to this abrasion effect. One of the results of fabric abrasion that mostly affect its surface appearance is occurrence of pilling phenomenon. Pilling is composed of small balls adherent to the fabric surface as a result of the entanglement of fibre ends as a consequence of the repeated action of friction forces that act according to two combined mechanisms: the protruding of fibres from fabric surface and the persistence of formed neps (nep is a small knot of entangled fibres consisting either entirely of fibres or of non-fibre particle entangled with fibres.) at the same surface. Therefore, there is a need of the mechanismfor assessment of degree of pilling on fabric surface as a product quality check measure.

Regardless of cause or consequentiality of its assessment during quality monitoring, the occurrence of pilling is undesired and has no resolution afterwards. It drastically changes appearance of the fabric thereby compromising its acceptance for apparel work.

Visual examination by experts to evaluate pilling and assigning grade to the same is prevailing industry practice. However, this technique is dependent on subjective opinion, skills, availability of such expert and thus, lacks both accuracy as well as reproducibility.

Hence objective evaluation is the requirement of the textile industry in purview of which there exists a pressing need for technology capable of assessing degree of pilling on fabric surfaces. Survey showed few attempts have been made previously, at achieving the need mentioned hereinabove. Automation in this perspective is an aspect therefore attracting interest of researchers in the textile industry.Among recent technical advances forming, a few objective assessment methodologies integrating lasers, 2D or 3D digital imaging (video / CCD cameras for mono/stereovision), [1-4]Optical Coherence Tomographyto extract pilling information and analysis protocols based thereon have been reported. Image analysis is used to evaluate quantitative and textural indicators of pilling intensity. Infra-red light has been used to map the surface of the knitwear [5].Image analysis could be put to extensive assessment of effect of fabric related parameters such as yarn twist, spinning method, warp and weft density, fabric cover factor and fabric singeing on pilling propensity of polyester-cotton blended woven fabrics[6].

All these involve architectures which are both complex and expensive to manufacture, operate and maintain.Hence the need to invent for the present inventors who, as result of targeted research, have come up with novel solution which effectively addresses all issues mentioned hereinabove.

## 2. Materials and Methods

The present system refers to the method for collecting (recording) pilling information in non-contact manner,from the pilled surface of fabric sample, without disturbing the fabric specimen. Main design focus is on simplicity, as machine is assembledusing commercially available and affordable, easy to configure components including a personal computer (PC), flatbed scanner. The roller mechanism which supports pill-cylinder mounted with fabric sample and electronics to control roller movement with optical sensors(figure 1 and figure 2)is the heart of the machine[7].

The operation cycle to run the machine consists of logical and convenient steps, which can be easily mastered by operator, illustrated by flowchart. (figure 3)First scanner is activated from personal computer,Electronics associated with machine is then activated.As scanner's sensor-light head rolls on, it passes two phototransistors mounted parallel and close to longer-side of the scanner, near resting position of the scanner light head. The travel time between these two photosensors are used by Microcontroller to manage rotational and horizontal movement (figure 4 and figure 5) of pill cylinder.It is required as resolution of scanning selected, changes speed of scanner's sensor-light movement. Scan obtained is identical to the scan if the fabric specimen is spread flat on the scanner glass plate. Figure6 shows first prototype of the system with old scanner.

PIC16F877a is a PIC Microcontroller and is normally used in Embedded Projects like Home Automation System, Bank Security System etc. This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into a 40-pin package. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC microcontrollers are consistent and faulty of PIC percentage is very less. The performance of the PIC microcontroller is very fast because of using RISC architecture. When comparing to other microcontrollers, power consumption is very less, and programming is also very easy.

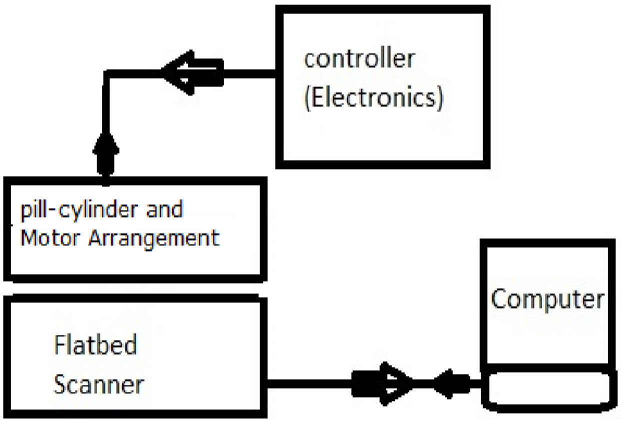


Figure 1-System Block Diagram

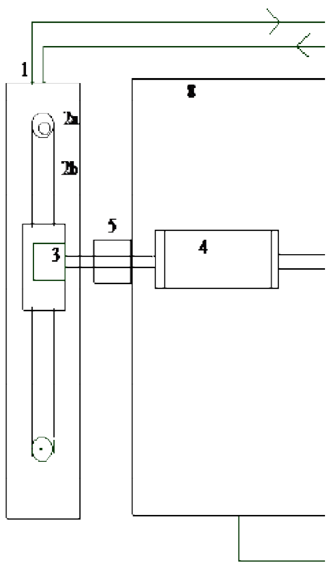


Figure 2- Assembly level diagram

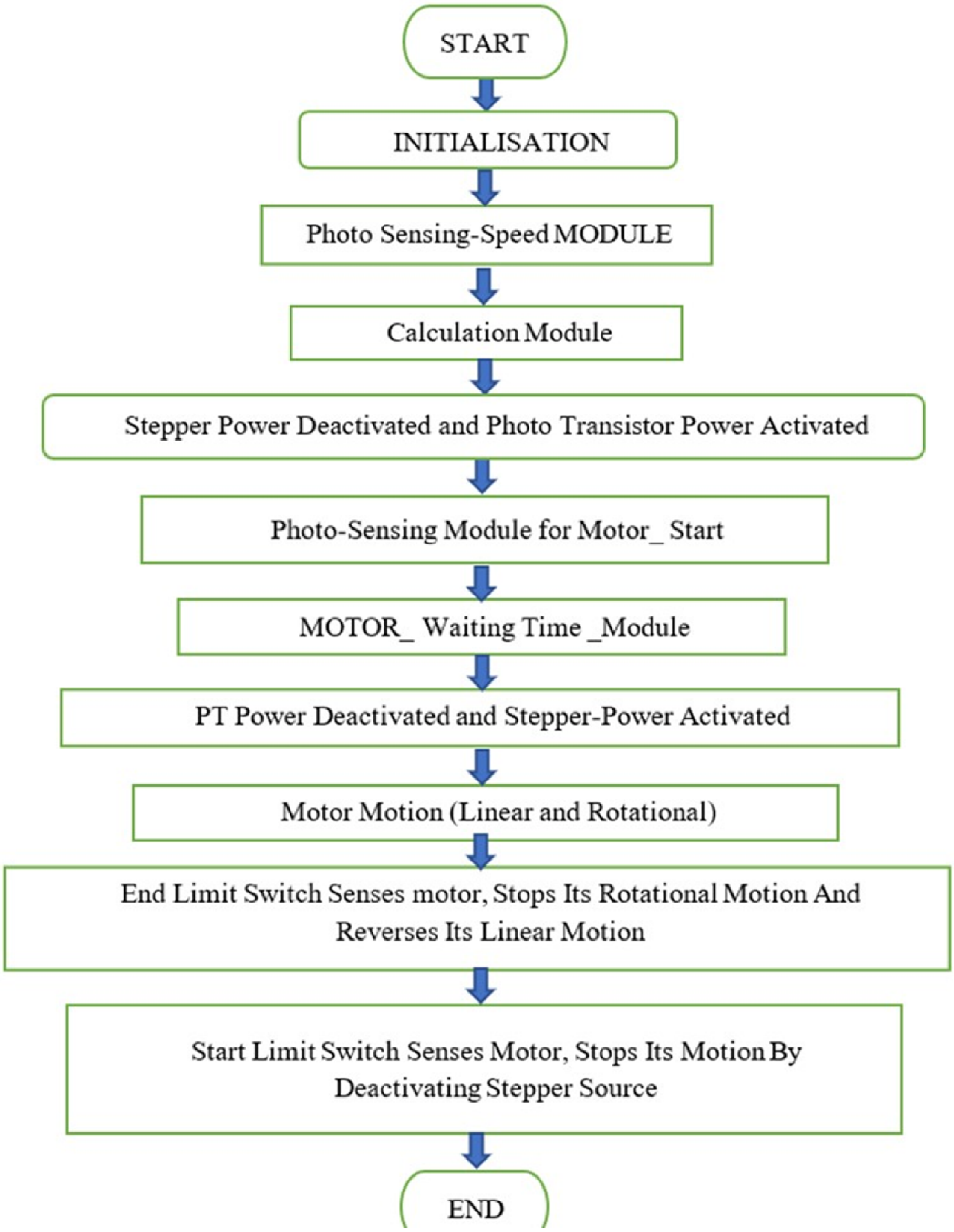


Figure-3-Flow chart of operation of Machine

Fabric samples of different types are investigated for the study of objective evaluation of Pilling Propensity. These Samples can be segregated into two groups:

(1) Naturally pilled fabric samples (NPFS)
(2) Artificially pilled fabric Samples (APFS)

using random tumble box pilling generatoras per textile Industry testing norms.
Cloth selected for the study of pill-propensity on fabric surface, was on the basis that it shows largest tendency towards pilling, because then pills remain strongly bound to the surface. Fabric is mounted on standard pill cylinders and subjected to random tumbling box method of pilling. After every 4500 rotations, the pill-cylinders are removed and scanned.The pill cylinders are scanned on the pill machine, designed for non-contact scanning of pill cylinders with pilled fabric mounted, after every 4500 rotation till 18000 rotations, 4 scannings for each fabric sample.

## 3. Results and Discussion

Scanning of the Surface profile of the pilled fabric specimen (Figure 7) was carried out using prototype machine designed and assembled in the laboratory. By employing wavelet analysis and MATLAB program, data about pill area, pill size of all the pills present on the surface of the pilled fabric specimen collected. Later MOTIC stereo microscope (Figure 8) employed to measure same data for the same pilled fabric specimen.Correlation been found between these two datasets, the corelation coefficient R was found to be 0.96 as shown in figure 9. This validated the utility of the Machine for measurement of pilling potential of the given fabric material[8-10].

Figure 4- Entire machine Assembly

Figure5-Machine with scan on computer

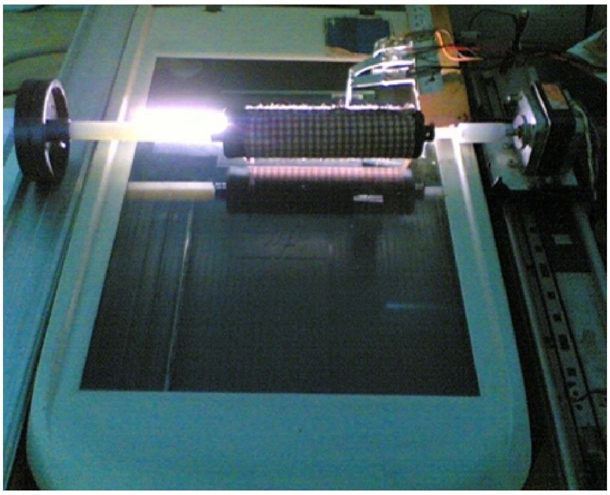

Figure 6- First prototype with old scanner

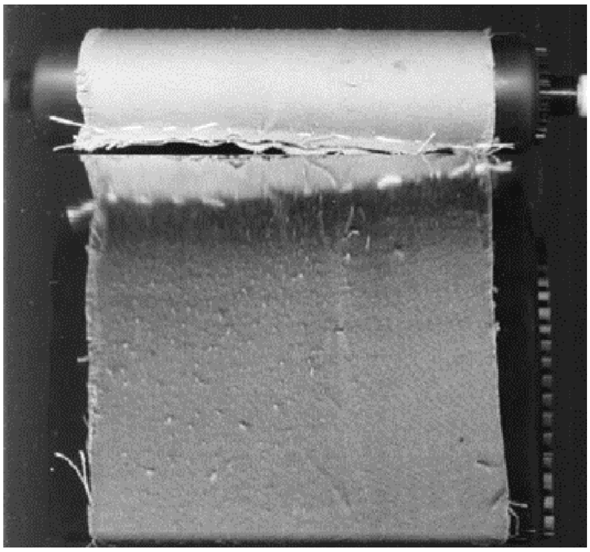

Figure 7- Non-Contact Scan of fabric surface

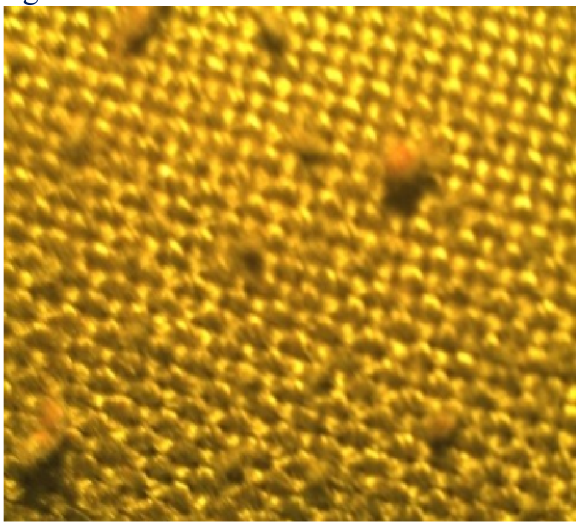

Figure 8- Pilled surface on Motic stereoscope

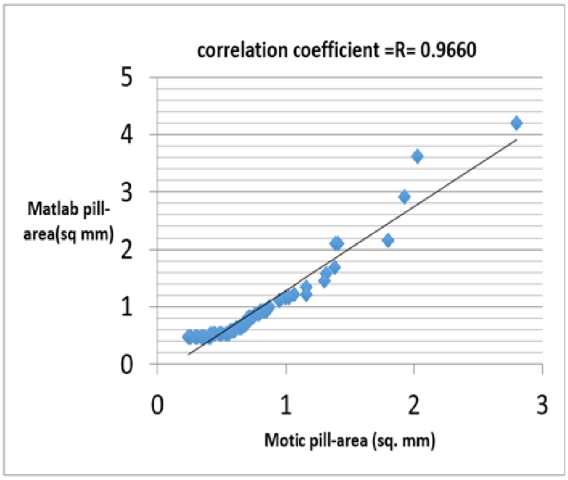


Figure 9-Validation by stereo microscope

## 4. Conclusion

A new machine has been fabricated using flatbed scanner, personal computer, electronics-control boards and mechanical track, to scan pilled fabric in non-contact mode. Objective evaluation of pilled specimenand measurement of pilling propensity by Present designed system,therefore, is one more advance step towards understanding Pilling Phenomenon in more objective manner.

## 5. Acknowledgement

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