

Machine Vision based quality control and fault detection of a textile dyeing machine

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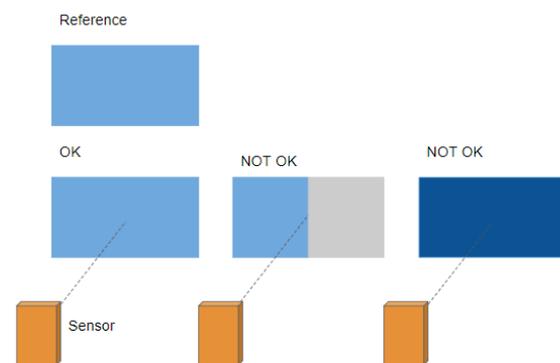
Fault detection systems are used in a variety of machines and industries to ensure good quality and reliability. Automatic fault detection systems possess many advantages since they can operate very fast when detecting and classifying different faults. They can also help increase the general level of automation and reduce the need for user interaction.

A fault detection system is used to identify when a fault has occurred. The most common way of doing this is by comparing signals or values of a currently operating application to its known correct operation. A fault detection system can also include the functionality of determining the cause and location of the fault. Many different methods for detecting faults exist, where machine vision is one of them. Machine vision is a technology used to automatically inspect and analyze an image captured by a camera. Different data, such as colour, grayscale or different shapes, can be extracted from an image and used to compare images to each other or to a reference and by this a fault can be detected.

The purpose of this project was to create a fault detection system for a textile dyeing machine using a smart sensor. The main functionality of the system should be to detect whether a fault had occurred or not, but the system could also be extended to determine the cause and location of the fault. Additionally, other possible solutions could be researched and compared to the sensor used in this project.

Since the purpose of the project was to detect faults on a dyed piece of fabric, it was decided early on that the best approach would be to use colour data from an image and compare it to the colour data given by a correctly dyed piece. The sensor used was, however, a monochrome sensor, which means that it can only provide grayscale data and not colour data and therefore this had to be used.

A program, based on grayscale data, has been developed for the application. The way the program works is by comparing the mean grayscale and grayscale deviation values from an image with values from a correctly dyed piece of fabric. If the mean differs too much, the fabric can be considered to have the wrong colour and if the deviation differs too much, the fabric most likely contain white spots where the dye has not been applied. By using these two parameters it is possible to determine if a fault has occurred.



The program performs well when it comes to detecting faults on static fabrics. The main purpose of the program is to detect whether a fault has occurred or not, especially large faults, but the program can also provide an operator with some information about the cause and location of the fault. In order to develop a good and reliable fault detection system, a lot of testing needs to be done. The sensor can be configured in many different ways that affect the resolution and size of an image and different parameters, such as lighting and distance between sensor and object, affect the overall performance.

The fault detection system created in this project is not yet fully functioning and ready to be used, but it has been shown that it is possible to use a vision sensor to detect faults of different degrees.