

Automated Ceramic Tile Defects Inspection System Based on Texture Analysis

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Introduction

The ceramic tile manufacturing process has now been completely automated. When it comes to the final stage of the production, there are different types of surface defects such as holes, dirty spots, color bleeding, etc. Some of the defects are difficult to distinguish with the traditional techniques such as visual inspection. (Boukouvalas et al., 1994)

The proposed system is to develop an integrated system for the detection of defects on ceramic tiles based on image processing and embedded system.

Methodology

Instead of human vision, computer vision system is used to classify the tile. First of all a picture of the tile is taken and image processing steps are applied to image. This stage includes pre-processing, image enhancement and feature comparison techniques. After getting the data consisting of the frequencies of masks, RULES-3 algorithm (Aksoy, 1993) is employed to determine the level of defect of the tile based on the features extracted and then pattern recognition is performed.

Based on the output produced by the image processing system, the microcontroller and the camera are controlled. In this process camera takes a picture of the tile and send it to the image processing program. After analyzing the image, relevant signal is generated by the system and passed to the microcontroller to control the production line.

Due to the availability of pre-defined libraries for the implementation, Visual Studio framework has been used for implementation and 16F877A microcontroller is used as the controlling component.

Result and Discussion

The above automatic inspection procedures have been implemented and tested on a number of tiles using synthetic and real defects. Accuracy of color object recognition part depends on light condition of the environment and accuracy of the results of image processing program depends on the quality of the image. Further, the micro-controlling process (hardware component: figure 1) depends on the results produced by the computer system (application software: figure 2). The results suggest that the performance is adequate to provide a basis for a viable commercial visual inspection system.



Figure 1. Mechanical component



Figure 2. Software controller

Conclusions

It is hoped that the considerable advancement achieved in overall production through the automation of ceramic tile defect inspection will eliminate the customer complaint regarding product quality in considerable level. Furthermore, the findings of this project can have an impact in other industrial fields presenting similar problems such as in the textile industry for defect detection, loose threads detection, and colour shading classification on fabrics.

References

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Boukouvalas, C., Kittler, J., Marik, R., Mpetrou., 1994. “ Automated grading of ceramic tiles using machine vision” In IEEE Int. Symposium on Industrial Electronics, pages 13- 84.