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Surface Defect Detection in Tiles Using Image Processing

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ABSTRACT: The Paper presents the Idea on Quality control is an important issue in the ceramic tile industry. Whole business and the brand name are dependent upon the quality of produced goods. On the other hand, maintaining the rate of production with respect to time is also a major issue in ceramic tile manufacturing. Again, price of ceramic tiles also depends on purity of texture, accuracy of color, shape etc. A large amount of ceramic tiles are constructed in the ceramic tile industry and it is very problematic to monitor the quality of each and every tile manually. Defect detection is generally done manually while manufacturing may be fully automatic. Tile's surface commonly suffers from cracks, holes, spots and corner defects. Classification process is achieved using the human visual appraisal to find and to analyze defect, where human perception is dependent thoroughly on experience and expertise. This operation wants a mechanical arrangement which can furnish an estimate of the ceramic condition precisely and frequently. Therefore, our aim is to enhance quality control by integrating various image-processing techniques, before dispatching of the final product to make no rejection rate. An automated system is expensive at the installation but it is a one-time investment, compared to wages paid to labor for a long time it provides high productivity and economical as well.

KEYWORDS: tiles defect, image-processing, python, camera.

I. INTRODUCTION

Image processing is one of the mostly increasing areas in computer science. As technology advances, the analog imaging is switched to the digital system now-a-days. Every day, we capture huge amount of images which are very difficult to maintain manually within a certain period of time. So the concept and application of the digital imaging grows rapidly. Digital image processing is used to extract various features from images.

This is done by computers automatically without or with little human intervention. One of the most important operations on digital image is to identify and classify various kinds of defects. Thus to detect the defects from any image some methods are established and placed at three levels. At the lowest level, some techniques are available which deal directly with the raw, possibly noisy pixel values, with de-noising and edge detection being good examples. In the middle there are algorithms which utilize low level results, such as segmentation and edge linking. At the highest level are those methods which attempt to extract semantic meaning from the information provided by the lower level.

II. RELATED WORK

A For finding defects, various techniques can be applied on an image of a tile. Like thresholding, segmentation, subtraction of two images, clustering etc. In automatic inspection of apple quality, an image of a good apple is considered as a reference image, characteristic of the apple is obtained in terms of rules and image processing criteria by human expert. Then according to these evidences, other apples are examined and apple is classified in one of the predefined three categories. Probabilistic neural network (PNN) can be applied. Different weights are given to the edges of this network and network is divided into four stages. Training set is given to the input stage and this set is passing through the pattern and summation layer followed by output layer. Set of tile images is taken as training set. This set is trained by passing through various stages like applying mean filter, resize the image, make histogram of RGB value, calculation of average contrast, detection of edges, form feature vectors, make feature classes based on feature vector class and train the classifier for detecting various defects on surface. Apply these feature vectors to PNN and take output as a defect. Cracks, Spot, bumps, holes can be identified using various techniques. For that noise removal followed by binarization of image is done. Cracks can be identified based on figure aspect ratio and center of gravity equation. Spots can be identified using standard deviation using center of gravity, bumps and holes can be

identified using edge detection techniques like Sobel, Prewitt, and Canny. Histogram equalization is used for setting contrast of the image. Histogram equalization is very useful whenever in image; both background and foreground have bright colors or dark colors. Probability density function is used in histogram equalization.

III. METHODOLOGY

The above is the flow chart of methodology adopted by us:

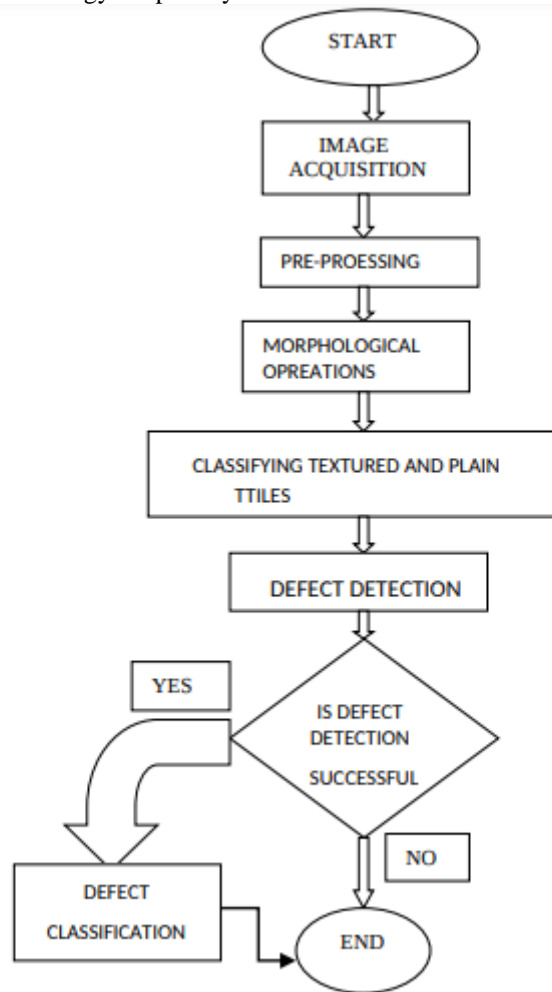


Fig.1Flow Chart For Working Process

The Waterfall Model was the first Process Model to be introduced. It is also referred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, each phase must be completed fully before the next phase can begin. This type of model is basically used for the project which is small and there are no uncertain requirements. In this model the testing starts only after the development is complete. In waterfall model phases do not overlap

Phases in Waterfall Model:

1. Information Gathering: In this we gather the information required to our system.
2. Design: After gathering the information required we design the model based upon that information.
3. Implementation: In this phase we actually implement the system using the design done in the design phase.
4. Testing: In this phase we perform the unit as well as integration testing to check whether the system is working as per our requirement or not.
5. Deployment: After testing the system we deploy the system in the market.
6. Maintenance: According to user feedback maintenance will be done

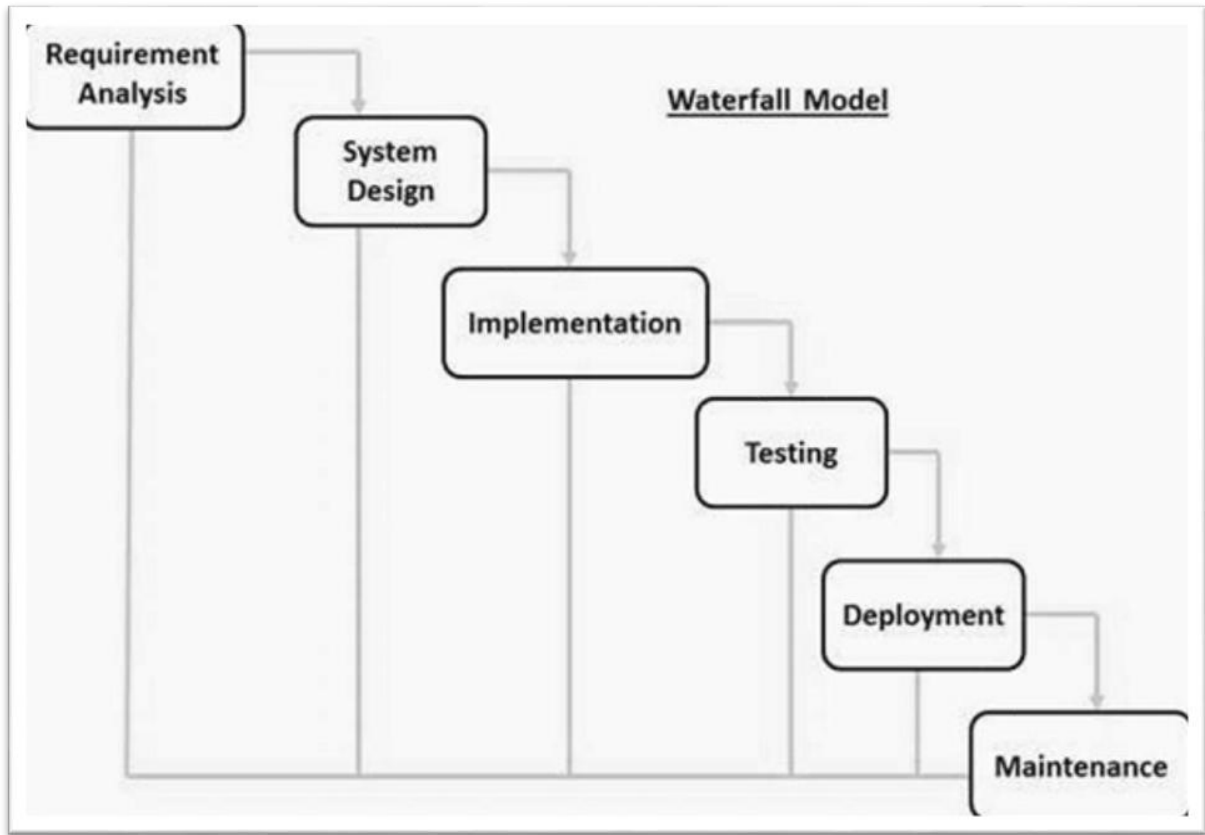


Fig.2 The System Development framework

IV. PROPOSED MODEL

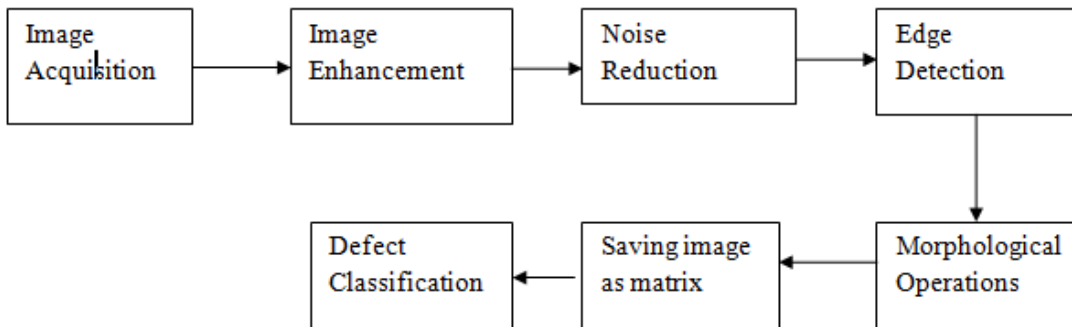


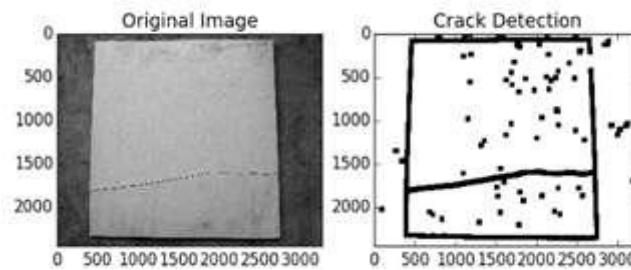
Fig.3 Block schematic

This project aims to create a visual system that is capable of detecting the surface defects for the ceramic tiles. That ensure the products are free from defects for the classifying process. Classifying process must be effectively, objectively and repeatedly, with sufficient rapidness and low costs. It must have the ability to adapt autonomously to changes in materials. In this section, we propose a new method for defect detection and classification. It can make the performance of defect detection rate higher than the existing one and can reduce the total computational time. Here, a

common sequence of operations is applied to detect different types of defects in ceramic tiles and some proposed algorithms are employed to classify them.

V. RESULTS

Results of some techniques are shown below. For Blob defect and variation in color, Canny edge detection technique is used. For Pinhole defect, first median filter is applied then threshold of 140 is taken for thresholding an image. For Crack defect, subtraction of reference image and current image followed by canny edge detection is applied. Experimental results of different types of defects are shown. For experimental results, Python IDLE configured with OpenCV is used.



Crack detection

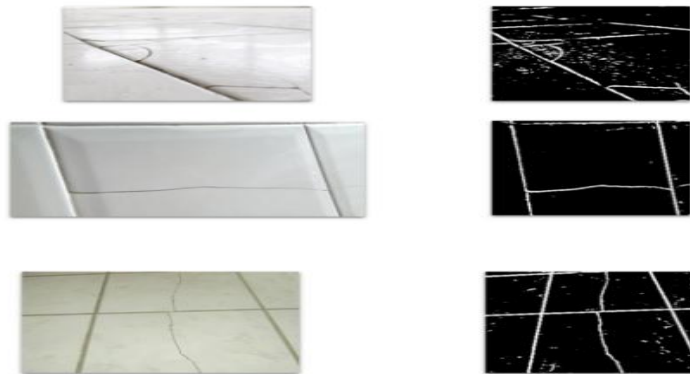


Fig.4 Final Circuit

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