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A novel design and implementation of crack pattern analysis using image processing

Shreenidhi
shreenidhi.15is@saividya.ac.in
Sai Vidya Institute of Technology, Bengaluru, Karnataka

Vinushree G. P.
vinushreegp.15is@saividya.ac.in
Sai Vidya Institute of Technology, Bengaluru, Karnataka

Sindhu K.
sindhuk.15is@saividya.ac.in
Sai Vidya Institute of Technology, Bengaluru, Karnataka

Mamatha G.
mamatha.g@saividya.ac.in
Sai Vidya Institute of Technology, Bengaluru, Karnataka

ABSTRACT

Nowadays, cracks are more happening due to environmental changes, in the real-time scenario, cracks are very common in a wall, bridge, furniture, railway track. Cracks are the black marks that vanish the civil infrastructure. It indicates the safety status and it is typically developed within a few months or years.

Keywords— *Canny edge detection, Dilation, Histogram*

1. INTRODUCTION

Crack Detection is very import for the maintenance of concrete Structure and it is a method to identify the crack from the image automatically using image processing technique such as morphological operation, canny edge detection, gradient and histogram. Crack is a separation of the concert into two or more parts in building, roads. Manual inspection is very time-consuming.

The manual approach completely depends on the specialist's knowledge and experience but the human errors will be more. Hence, the automatic image-based crack detection is proposed as a replacement. To be effective, the image processing techniques used here must avoid complex computation such as high detection rate and accuracy. It is developed for achieving high performance in the following three aspects:

- **Detection Rate:** which means the crack detection approach must guarantee the majority crack length in the original image is detected as the output result.
- **Detection Accuracy:** which means the misclassified objects must be removed as much as possible.
- **Detection Efficiency:** The image processing must be fast and efficient and algorithms with complexity are not acceptable.

The above three requirements are the principle for developing the automatic crack detection and classification method. Morphological image processing operations is an advantage in segmenting relevant structures without calculations.

In past years, an inspection of cracks has been done manually by careful and experienced inspectors. Besides, the
Poor lighting conditions make it hard for inspectors to see the crack from a distance so developing an automatic crack detection and classification is an easy method to solve the problem.

It represents the different crack detection and classification techniques and the analysis is carried on the basis of image processing. The manual approach is very time consuming and labor intensive, by employing the camera to catch the crack images the automatic measurements by digital image processing can overcome the shortage of manual inspection to achieve effective preventative maintenance.

Gray scale images for existing crack detection are to be good enough, but the unaffected areas are also identified as cracks to address this problem we use the morphological operation. The morphological operation is used to enhance the image for crack segmentation. The various types of the crack based on their structure are micro crack, thin crack, line crack and large crack. And the crack is completely depended on the size of the image. The major advantage of crack detection by using image processing is it provides a good accurate compared to the manual methods. To be efficient, the image processing techniques used here must avoid the complex computations as a prerequisite for high detection rate and accuracy, the automatic crack detection measures the height and width of the crack.

2. PROPOSED SYSTEM

Automatic crack detection and classification system are proposed for concrete surface images. The objective of the project is to the analysis of crack in the wall, width and length of the cracks on the structural surface shows the earliest degradation level and carrying capacity of the concrete structures. And the crack that is not visible to human eyes can be identified and detected by our automatic image-based crack detection.

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3. METHODOLOGY

- Extract the different wall crack image from the camera.
- Convert to grey level image using pre-process.
- Find the crack pattern in an image.
- Post process through bounding box on finding a crack pattern.
- Find the difference between crack areas.

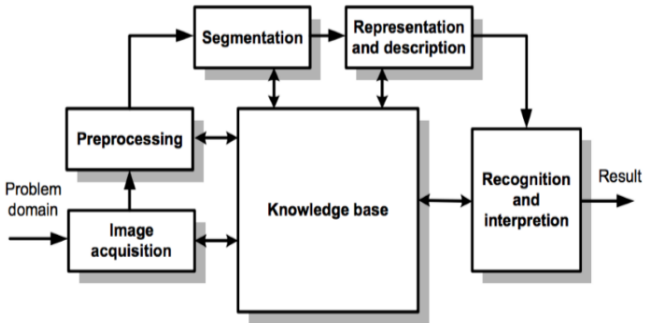

Fig. 1: Block diagram

3.1 Image acquisition

This is the first step in image processing image acquisition is done by the camera with the different resolution that is given to the preprocessing. The image acquisition stage involves preprocessing also.

3.2 Image pre-processing

This is the second basic step which is simplest in image processing. The idea behind this technique is to highlight a certain region of interest such as changing brightness and contrast.

3.3 Image segmentation

Image segmentation is a field that deals with the quality of appearance of an image with respect to image restoration based on the mathematical model of image degradation and also sorts the region of interest sends to the next step.

3.4 Representation and description

Here it uses gray scale conversion algorithm for gaining the image significant region. This may contain color modelling and processing in a digital domain.

3.5 Recognition and interpretation

Images are sub divided into smaller parts for data compression and for presentation as a result output is displayed with the use of wavelet for presenting an image with different resolution.

3.6 Knowledge base

It deals with compression for decreasing the bandwidth of image and calculates the height of each pixel and predict the accuracy of the experimental result.

4. IMPLEMENTATION

The proposed system has the following modules:

4.1 Extraction of the data module

This process can be done in two ways: static and dynamic data extraction. Dynamic data refers to live data that is being captured by the input devices, which in our case are the sensors and the camera.

4.2 RGB to the grey scale conversion module

The images that are obtained by the camera is in the form of RGB (Red, Green and Blue), refers to a system for representing the colors to be used on a computer display. These RGB images have to be converted to grey scale images so that it is easier to process these images and it also reduces the size of these images. 2. Edge Detection module:

The Canny Edge detection algorithm is used to detect the edges of the obstacles.

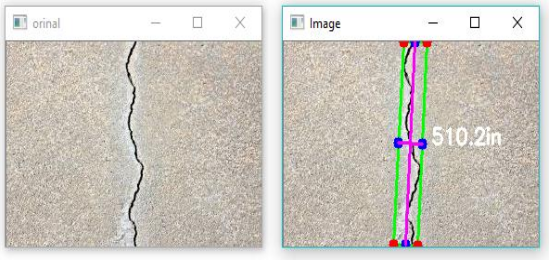

Fig. 2: RGB to the grey scale conversion module

5. CONCLUSION

In this paper, the proposed system of the automated crack monitoring system is implemented and tested with different walls. The cracks that are not visible to human eyes can be identified and detected by this automatic image-based crack detection proposer. The manual approach completely depends on the specialist's knowledge and experience but the human errors will be more. Hence, automatic image-based crack detection is proposed as a replacement.

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