Railway Track Oversight System

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Abstract- *Nowadays, train accidents have increased drastically due to bad maintenance of railway tracks. A survey says that a total of 895 people died and 2123 people were injured due to train derailment in India between the years 2010-2019. Poor maintenance of railway tracks is a major reason for many train accidents that have affected several innocent human lives. In an attempt to overcome this situation, the authors in this paper develop a solution that has several advantages over previously designed systems used for monitoring railway tracks. The proposed system is an accurate, cost efficient and faster mechanism in this regard.*

Keywords- Crack, Image processing, Matlab, Railway track

I. INTRODUCTION

The system is designed with the purpose that it helps in the detection of the cracks in the railway tracks so that accidents can be prevented which are caused due to faulty tracks. The principle behind the system is the use of the concept of DigitalImage Processing using MATLAB. This helps to convert an input image into grayscale mode in order to find the cracks that are usually small and hard to find by an input color image. The output image after applying various filters helps in identifying the crack and thus makes it easy to rectify before it expands and tears away the track segment apart.

II. LITERATURE REVIEW

Railways have always been one of the key modes of transportation to travel various cities so it is important to maintain the tracks in such a way that no crack should be allowed to keep expanding which might break that particular segment of the track and thus not allowing the train to travel in that particular track. In the past many engineers have posted solutions in order to detect crack as mentioned further.

In [1] the authors have used Node MCU with hall sensor used for measuring the change in magnetic field observed in the cracks and GPS module for precise location and uploading the data to cloud. In [2] the authors have integrated Arduino uno with ultrasonic sensor for crack detection,L298 Motor driver and GPS module for mapping geographical co-ordinates.All these parameters are visible vi android app.In [3] the authors have used cost-effective e PIC16F877A microcontroller with IR transmitter and receiver for crack detection,GSM module for precise co-ordinates of the location. In [4] Iot is the main principle used, sensors such as ultrasonic, IR and PIR are interfaced with Arduino uno and a gps module is used to track the location of the crack detected.In [5] the author has used integrated system which includes micro-controller,photodiode and LED for crack detection,motor driver for controlling the robot and LCD to display the total no cracks observed in that specific railway track.

While some of them proved to be effective in terms of solving the problem, many of them were not advisable due to the factors of availability of certain sensors, complex connections within the circuit which makes it difficult to backtrack for any wire that is short circuited, high cost for components , low efficiency as well as life term for certain circuits. Our system is designed to make sure that low cost is invested upon the system and yields accurate and efficient outputs which helps to make sure that the cracks in the railway tracks are treated properly before it expands

III.THEORY

The scanned image is fed to the system for the further process in detecting cracks by various image processing algorithms.

Fig 1. Input image

3.1 RGB to grayscale conversion

By preserving the brightness of a true color image, a grey scaled image is formed. This consists of various shades of grey color whereas the RGB image is a mixture of red, green and blue colors. In Matlab this is implemented by using

the Image() function which returns the pixel value of red, green and blue color which is then combined in a form by 30% of red, 60% of green and 10% of blue color to obtain the gray scale of the original image.

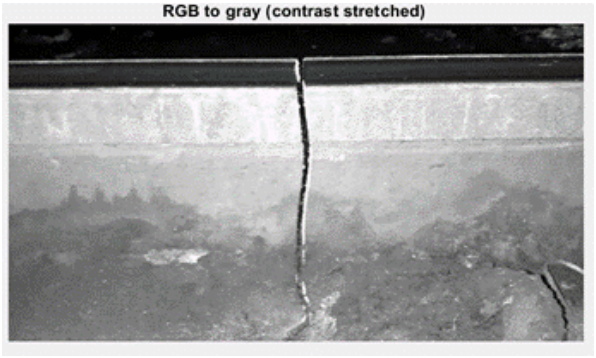

Fig 2. Grayscale image

3.2 Median Filter

Median filter is a pre-processing technique used to improve the results in later processes. It is actually used to remove noise from an image. Median filter is used to preserve edges during noise removal which is very crucial in image processing. Midfit2() is the function used in matlab to perform a median filter. Each pixel in the output image contains the median value in a 3-by-3 neighborhood around the corresponding pixel in the input image.

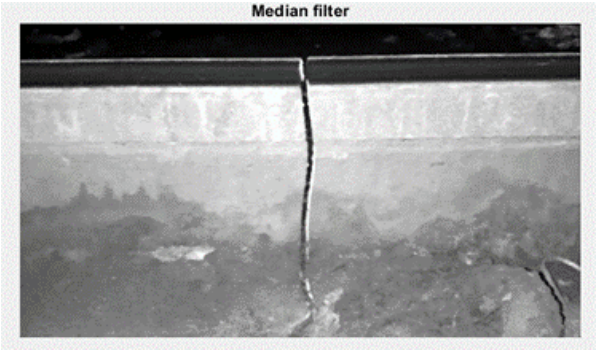

Fig 3. Image after median filter

3.3 Binarization

Binarization of image is the process of converting a grayscale image to black-and-white form, which is compressing the information in the 256 shades of grey to 2 shades which is also called as binary image. Im2bw() is the matlab function used to convert grayscale image to binary image by replacing all the pixel values of the input image by either 0 or 1. If the luminance is greater than the level with the value 1(white) and all others with 0(black).

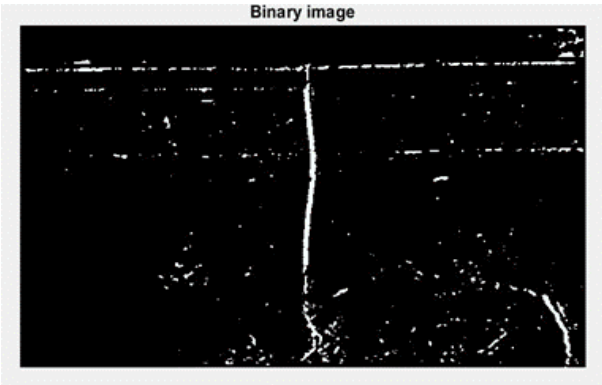

Fig 4. Binarized image

3.4 Noise reduction

Removal of noise is also known as filtering in digital image processing. It is a process by which a specific information is highlighted. This process is mainly used for various purposes in which edge detection is a major one. Imnoise() is the function we used in matlab to extract the required information from the binary image and below is the image after removing all the noises.

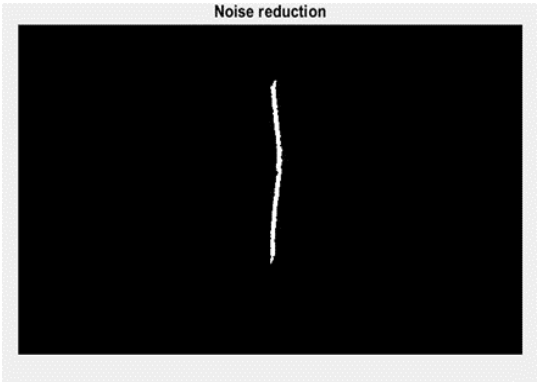

Fig 5. Noise reduced image

3.5 Thinning

Thinning is an operation which is used to remove specific foreground pixels from a binarized image. It is mainly used to reduce the thickness in edge detection. Here its role is skeletonization of the detected crack which produces another binary image. This process is helpful in measuring the correct pixel value of detected crack.

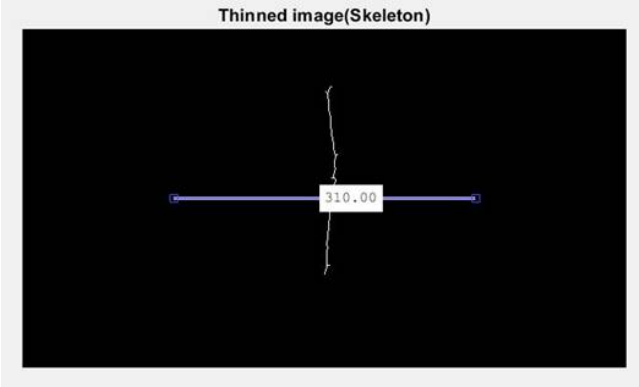

Fig 6. Thinned image with pixel length

IV.METHODOLOGY AND IMPLEMENTATION

4.1 Flowchart

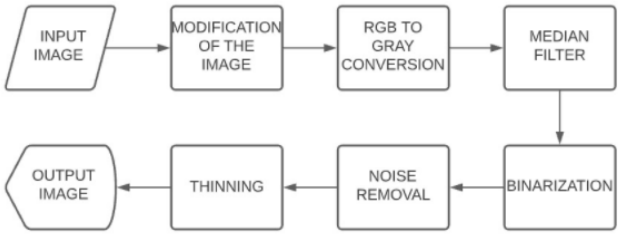

Fig 7. Block diagram

4.2 Implementation

The principle we used to implement this project is digital image processing which is a branch of digital signal processing. Matlab is the software we have used in this project to implement various algorithms of image processing as mentioned in the above flowchart. The Input image is passed through a set of functions sequentially and the result shows us the damaged portion and the length of the crack in pixels. These data are further uploaded to a cloud storage for further access and renovation.

4.3 Working

The customized hardware consists of the microprocessor Raspberry pi with camera used for capturing and processing the image.The received image is fed as input to the MATLAB software system.The image is initially modified according to the required input standards and undergoes conversion to grayscale.The noise removal of the image is performed by median filter. The image is converted into black-white scale by the binarization process. After conversion, the image once again undergoes noise removal for accurate detection of the crack. The final processing of the image consists of thinning of the image where the thickness and correct pixel value of detected crack is displayed.The final output image is uploaded to the cloud with corresponding input image, timestamp and location.

IV. RESULT AND CONCLUSION

In this paper we have represented a Railway Track Oversight System using MATLAB. The final output of the detected crack with the pixel length is shown below.

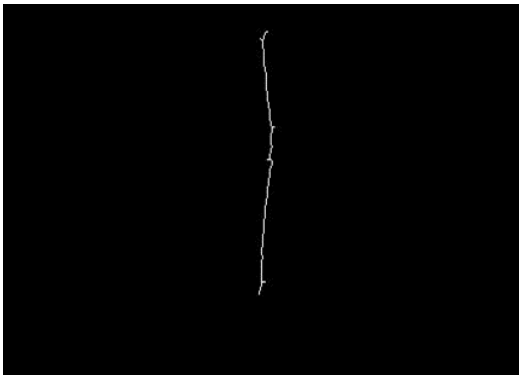

Fig 8. Output image

This system was designed with the purpose of detecting cracks on the railway track. By using this system, one can avoid accidents that occur due to cracks that are available on the railway track. The system detects the output image and visualizes the cracks if available on the railway tracks. This information is stored in a cloud database along with the timestamp and location on when the crack was detected by the system. This helps the workers who are supposed to repair the cracks before it expands further and causes fatal damage to any train that passes by on that particular railway track.

V. REFERENCES

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