**Detection of Damage on Steel Manufacturing**

*Report submitted to the SASTRA Deemed to be University as the requirement for the course*

**ICT300 - MINI PROJECT**

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i



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**Bonafide Certificate**

This is to certify that the report titled “**Detection of Damage on Steel Manufacturing**” submitted as a requirement for the course, ICT300: **MINI PROJECT** for B.Tech. is a bonafide record of the work done by **Iraianban S (Reg.No:124014017, B.Tech-ICT) , Sanjai Praveen S (Reg.No:124014043, B.Tech-ICT) , Swetha S (Reg.No:124014055, B.Tech-ICT)** during the academic year 2021-22, in the School of Computing, under my supervision.

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**Examiner 1** **Examiner 2**

ii

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iii

**List of Figures**

|  |  |  |
| --- | --- | --- |
| **Figure No.** | **Title** | **Page No** |
| 1 | Input Images |  |
| 2 | Visual Inspection by manually |  |
| 3 | Visual Inspection By Matlab Code |  |
| 4 | Resized Image |  |
| 5 | Image after Roughness Analysis |  |
| 6 | Image after Color Analysis |  |
| 7 | Image after Combination of Roughness Analysis and Color Analysis |  |

iv

**Abstract**

The traditional method used for corrosion damage assessment is visual inspection which is time-consuming for vast areas, impossible for inaccessible areas and subjective for nonexperts . A promising way to overcome the forementioned drawbacks is to develop an artificial intelligence-based algorithm that can recognize corrosion damage in a series of photographic images. A numerical framework for screening of uniform corrosion on steel structures . A fully automated, fast and objective screening for corrosion. A database of digital images including rust stains, non-uniform illumination, etc. Image analysis based on the roughness and color analysis, and a performance metric. This algorithm quantifies and combines two visual aspects – roughness and color – in order to locate the corroded area in a given image. For the roughness analysis, the uniformity metric calculated from the graylevel co-occurrence matrix is considered. For the color analysis, the histogram of corrosion representative colors extracted from a data-set in HSV color space is used. The algorithm has been applied to a large dataset of photographs of corroded and non-corroded components and structures. Our findings show that the developed algorithm can efficiently locate corroded areas.

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**KEY WORDS:** Visual Inspection , Roughness Analysis, Color Analysis

v

**Table of Contents**

**Title Page No.**

Bonafide Certificate ii

Acknowledgements iii

List of Figures iv

Abstract v

1.Summary 1

2. Merits and Demerits of the base paper 3

3. Source Code 4

4. Snapshots

5.Conclusion and Future Plans

6. References

7.Appendix – Base Paper

vi

**CHAPTER 1**

**SUMMARY OF THE BASE PAPER**

**Base Paper Details:**

Title : Detection of corrosion using automated image processing

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**Summary:**

**Introduction:**

Corrosion is a frequently occurring failure mechanism for steel structural members and components. To give an idea, for engineering components this mechanism takes the lead in terms of the frequency of failure with 42%, according to (Petrovic, 2016). The first step towards the maintenance of structures is Visual Inspection (VI). This approach only treats surface defects and delivers a rough description of the condition of the structure and its deterioration. The occurrence of corrosion comes with two main visual characteristics. In the first place, it creates a rough surface texture and secondly, the colors of the by-products are situated within a well-defined color spectrum. Therefore the use of texture analysis, color analysis or a combination of both is often used to develop algorithms for corrosion detection.

**Corrosion Detection Algorithm:**

From the visual inspection point of view, a corroded area has a surface rougher than a non-corroded one and its color looks like a hue between red and brown. the main part of the algorithm first consists of a roughness analysis. The identified rough area is transferred as a candidate corroded region to the second step, i.e. the color step, for further investigation. In the color step, the color of the candidate area is compared with the predefined colors of corrosion. Finally, the outcome of this algorithm is a map showing the locations of detected corrosion.

**1**

**Roughness Analysis:**

A non-corroded surface has a quite uniform color distribution but a corroded surface has a non-uniform distribution of corrosion colors. One way to quantify the color distribution of a portion of an image, hereafter called patch, is to measure its uniformity . It should be mentioned that uniformity yields a value between 0 and 1. A value equal to 1 means that the investigated patch has a uniform color distribution which is interpreted as a non-corroded patch, and a value equal to 0 means that the patch has a non-uniform distribution of colors which might indicate the presence of corrosion.

**Color Analysis:**

By-products of steel corrosion at atmospheric conditions are shades of red, yellow and red-brown. So by quantifying corrosion colors and comparing them with a reference color, one can make a classifier for corrosion detection. The first step for quantification is to select the appropriate color space. Based on our investigation, the HSV color space seems to be the most appropriate color space for describing colors related to corrosion.

**Performance Metrics:**

In a perfect corrosion detection, the values for both precision and recall are equal to 1. Although having an algorithm which leads to a precision and recall near 1 is ideal, this situation is unlikely in real applications. So one has to select one of these two values as the final performance metric.

**Dataset:**

Dataset Name: Corrosion Image Data Set for Automating Scientific Assessment of

Materials

Description : Curate a novel dataset consisting of 600 images annotated with

expert corrosion ratings obtained over 10 years of laboratory

corrosion testing by material scientists. Based on this data set,

we find that non-experts even when rigorously trained with

domain guidelines to rate corrosion fail to match expert ratings.

Challenges include limited data, image artifacts, and millimeter-

precision corrosion.

**2**

**CHAPTER 2**

**MERITS AND DEMERITS OF THE BASE PAPER**

**Merits:**

1. Corrosion Detection using Automated image processing provides an objective and accurate way, because it eliminates human bias and errors in corrosion detection.

2. It saves time compared to manual visual inspection and analyze large number of image data in short time.

3. It is not necessary to any physical contact with the surface of the steel structure.

4. It is easy to handle, and it doesn’t need any high level of technical experts.

**Demerits:**

1. It is expensive to maintain.

2. It only detect corrosion in outer surface.

3.Poor quality of images may affect accuracy of the result.

4.It gets effected to external conditions such as temperature, humidity etc.

3

**CHAPTER 3**

**SOURCE CODE**

**CHAPTER 4**

**SNAPSHOTS**

**CHAPTER 5**

**CONCLUSION ANS FUTURE WORKS**

**Conclusion:**

The roughness analysis appropriately determines almost the entire image as ‘rough’. Because not every rough surface implies corrosion. The colour analysis appropriately determines the corroded surface and also the rust strains as corroded regions. Considering the above drawbacks the combination of roughness and colour analysis gives more efficient and accurate result to determine the corroded region.

**Future Works:**

1.Corrosion detection using sensing technologies such as ultrasonic, magnetic flux leakage, or eddy current to improve the accuracy.

2.Corrosion detection can be continuously monitoring by real time monitoring system to prevent damage in early stage.

3.Corrosion detection using CNN to improve accuracy.

4.Corrosion detection can be done in extreme condition like off-shore platform or pipelines.

**CHAPTER 6**

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**CHAPTER 7**

**APPENDIX**

**Base Paper Link**[**:** https://doi.org/10.1016/j.dibe.2020.100022](file:///C:\Users\User\Downloads\:%20https:\doi.org\10.1016\j.dibe.2020.100022)