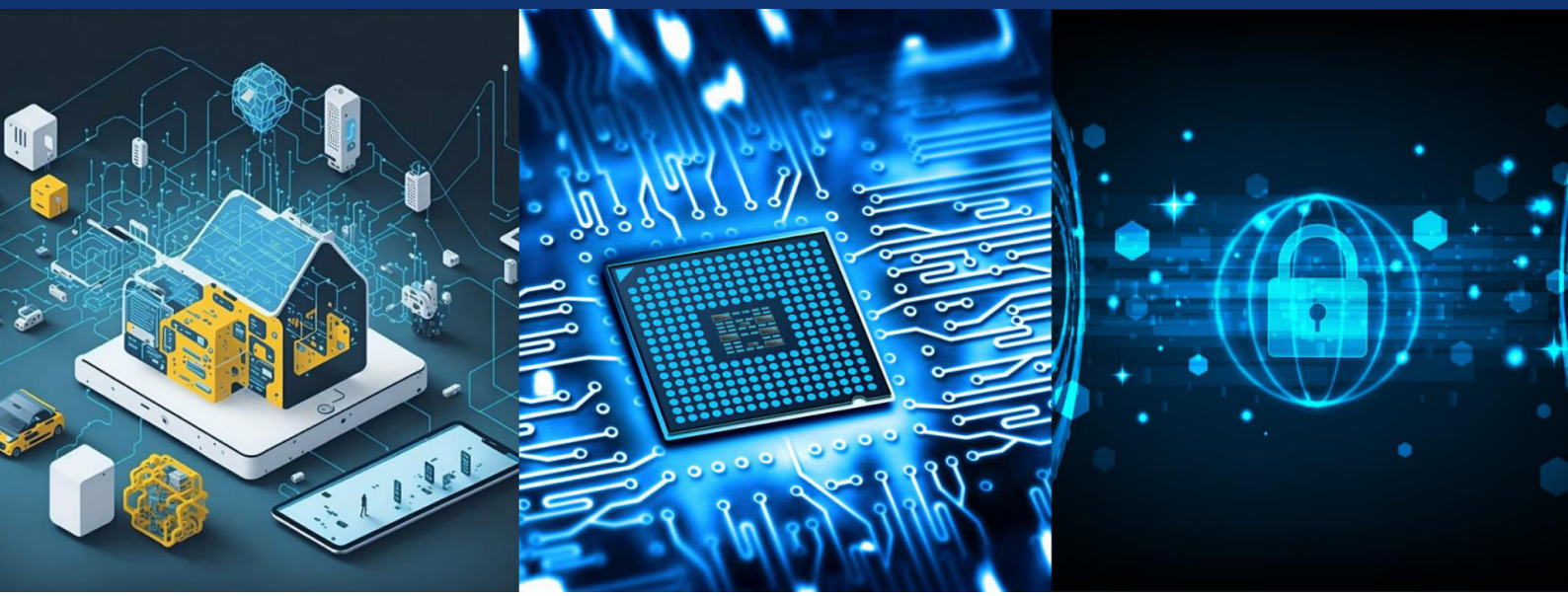
IJIRCCE

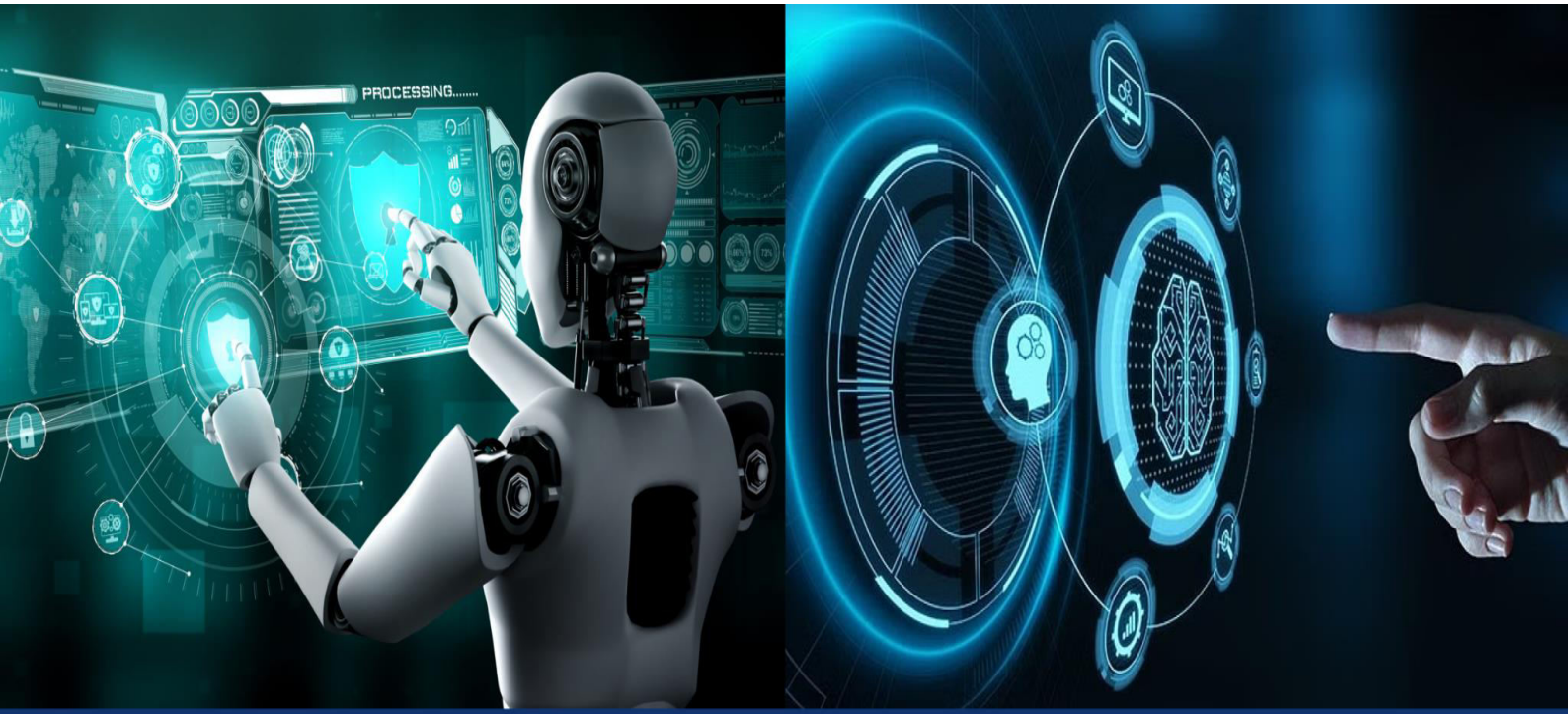
ISSN(O): 2320-9801

ISSN(P): 2320-9798



International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.771

Volume 14, Issue 4, April 2026

© 2026 IJIRCCE | Volume 14, Issue 4, April 2026 DOI: 10.15680/IJIRCCE.2026.1404093

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

To Design an Artificial Neural Network Based Quality Inspection System for Automobile Components

C.Prakash Narayanan[1], S.Mercy Priya[1], Dharanidharan S[2], Solavarman J[2], Sriram P[2]

Assistant Professor, Department of Computer Science and Engineering, P.S.V College of Engineering and Technology, Krishnagiri Dt., Tamil Nadu, India[1]

UG Scholars, Department of Computer Science and Engineering, P.S.V College of Engineering and Technology, Krishnagiri Dt., Tamil Nadu, India[2]

ABSTRACT: This project titled "To design an artificial neural network based quality inspection system for automobile components," presents an advanced Quality inspection in automobile manufacturing is a critical process that ensures safety, reliability, and performance of components. Traditional inspection methods are often time-consuming, labor-intensive, and prone to human error. This paper proposes an Artificial Neural Network (ANN)-based quality inspection system to automate defect detection in automobile components. The system utilizes image processing techniques combined with ANN to classify components as defective or non-defective. The proposed model improves accuracy, reduces inspection time, and enhances productivity. Experimental results demonstrate that the ANN-based system achieves high precision and reliability compared to conventional methods.

KEYWORDS: Artificial Neural Network, Quality Inspection, Automobile Components, Machine Learning, Image Processing

Domain: FullStack Development

I. INTRODUCTION

In the automobile industry, maintaining product quality is essential to ensure safety and customer satisfaction. Traditional inspection systems rely heavily on human operators, which may lead to inconsistencies and errors. With the advancement of artificial intelligence, automated inspection systems have gained importance.

Artificial Neural Networks (ANN) are powerful tools capable of learning patterns from data and making intelligent decisions. By integrating ANN with image processing, it is possible to develop an efficient quality inspection system. This paper focuses on designing such a system to detect defects in automobile components accurately and efficiently.

II. LITERATURE REVIEW

"Deep Learning for Automated Visual Inspection in Manufacturing"
This study highlights the use of convolutional neural networks (CNNs) for detecting defects in industrial products. It demonstrates how deep learning improves accuracy compared to traditional inspection methods.

"Machine Vision Systems for Automobile Quality Control"
This research explains how machine vision systems are used in automobile industries for identifying surface defects. It emphasizes the importance of automation in improving inspection speed and reliability.

"Artificial Neural Networks for Defect Detection"
This paper discusses how ANN models can classify defective and non-defective components using training datasets. It shows the effectiveness of neural networks in pattern recognition tasks.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

"Image Processing Techniques in Industrial Inspection"
This work explains preprocessing techniques such as filtering, edge detection, and segmentation, which are essential for improving defect detection accuracy.

III. METHODOLOGY

1. EXISTINGSYSTEM

Existing quality inspection systems in automobile industries mainly rely on manual inspection or basic automated tools. Manual inspection requires human operators to visually check each component, which is time-consuming and inconsistent. Some automated systems use simple image processing techniques but lack intelligent decision-making capabilities.

2. DISADVANTAGE

1. High dependency on human inspection leading to errors
2. Time-consuming and inefficient for large-scale production
3. Limited accuracy in detecting minor defects
4. Lack of real-time processing capabilities
5. Inconsistent results due to human fatigue

3. PROPOSED SYSTEM

The proposed system is an Artificial Neural Network-based inspection system designed to automatically detect defects in automobile components using image data. The system captures images of components, preprocesses them, and feeds them into a trained neural network model for classification.

The ANN model analyzes features such as shape, texture, and edges to identify defects. The system provides real-time results, ether a component is defective or acceptable. This improves accuracy, reduces inspection time, and enhances production efficiency.

4. ADVANTAGES

1. High accuracy in defect detection
2. Reduces manual labor and human error
3. Faster inspection process
4. Real-time analysis and decision-making
5. Scalable for industrial applications
6. Improves overall product quality

5. DESIGN OF THE SYSTEM

The system is designed using a layered architecture consisting of:
Image Acquisition Layer (captures component images)
Preprocessing Layer (filters and enhances images)
Feature Extraction Layer (extracts relevant features)
ANN Model Layer (classifies defects)
Output Layer (displays inspection results)
The workflow follows a sequential process where input images are processed and analyzed to produce accurate inspection results.

© 2026 IJIRCCE | Volume 14, Issue 4, April 2026 DOI: 10.15680/IJIRCCE.2026.1404093

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

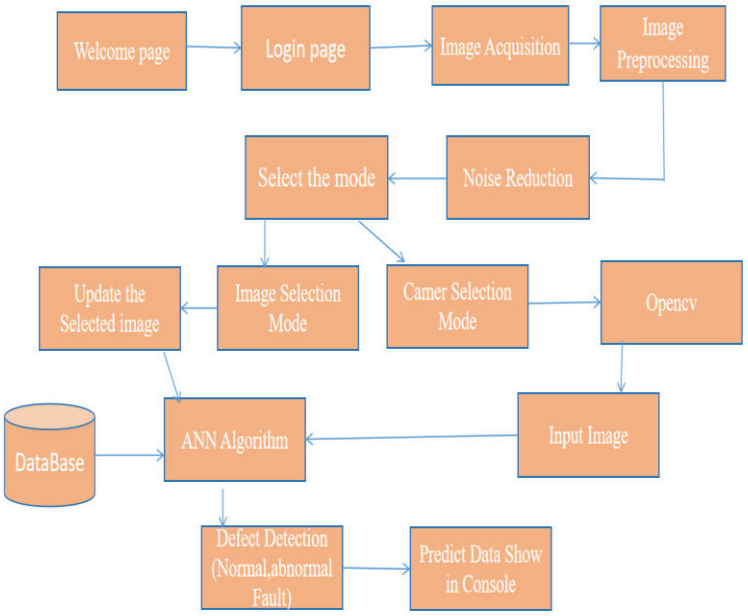


Fig.1 The system captures images, processes them using ANN, and outputs defect detection results.

IV. IMPLEMENTATION

MODULEDESCRIPTION

1. Image Acquisition Module

This module captures images of automobile components using cameras or sensors. It ensures high-quality image input for accurate processing.

2. Image Preprocessing Module

This module enhances image quality by removing noise, adjusting brightness, and normalizing images for better analysis.

3. Feature Extraction Module

This module extracts important features such as edges, shapes, and textures from the images to help in defect identification.

4. ANN Classification Module

This module uses a trained artificial neural network to classify components as defective or non-defective based on extracted features.

5. Defect Detection Module

This module identifies specific defects such as cracks, scratches, or deformities in components.

6. Result Display Module

This module displays the inspection results to the user, indicating whether the component passes or fails quality standards.

7. Database Module

This module stores images, inspection results, and training data for future analysis and model improvement.

8. User Interface Module

This module provides a user-friendly interface for monitoring inspection results and managing the system.

© 2026 IJIRCCE | Volume 14, Issue 4, April 2026 DOI: 10.15680/IJIRCCE.2026.1404093

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

V. RESULT

The developed system was tested using various automobile component images with different types of defects. The ANN model successfully identified defects such as cracks, scratches, and surface irregularities with high accuracy.

The preprocessing module improved image clarity, enhancing detection performance. The system demonstrated real-time processing capability, making it suitable for industrial applications. The results showed that the ANN-based approach significantly outperforms traditional inspection methods in terms of accuracy and speed.

Fig.1

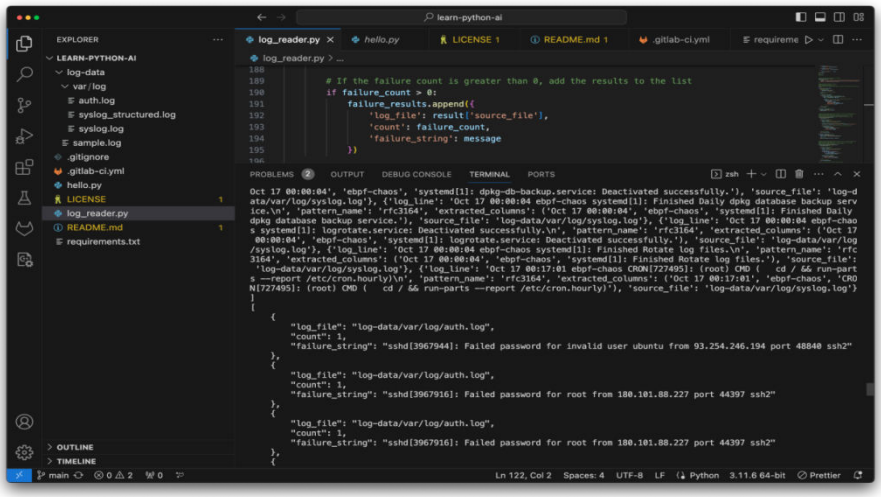


Fig.2

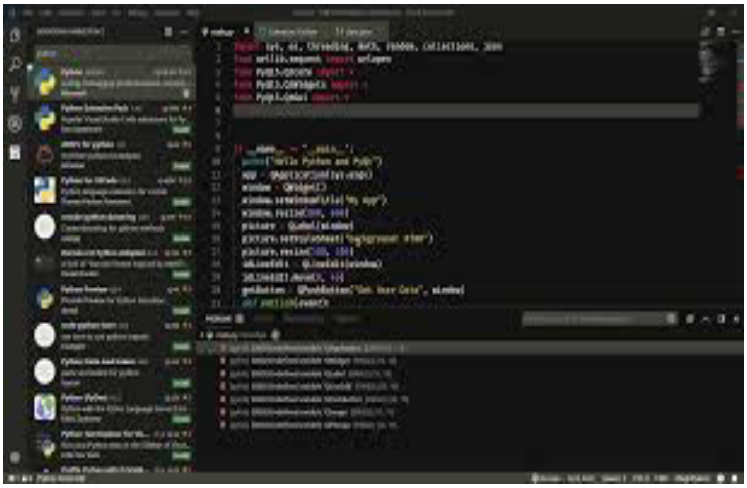


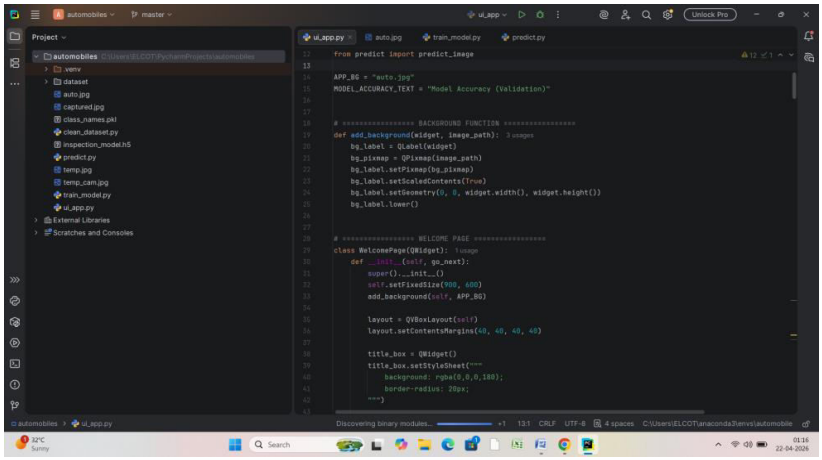
Fig 3

© 2026 IJIRCCE | Volume 14, Issue 4, April 2026 DOI: 10.15680/IJIRCCE.2026.1404093

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



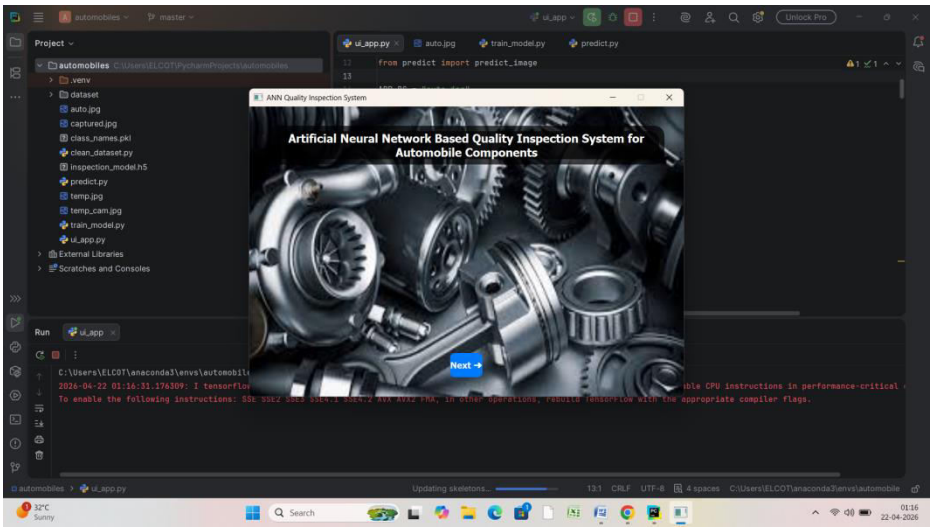


Fig.4

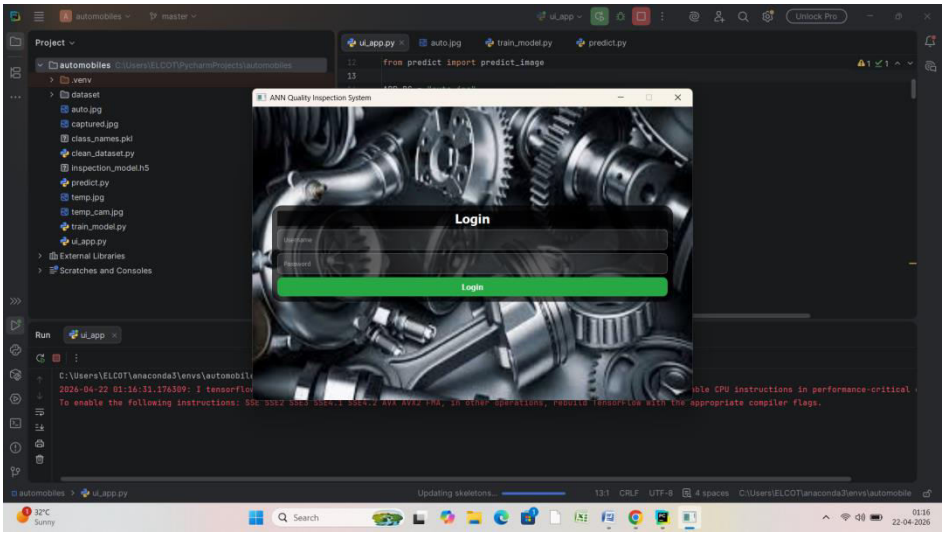


Fig.5

© 2026 IJIRCCE | Volume 14, Issue 4, April 2026 DOI: 10.15680/IJIRCCE.2026.1404093

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

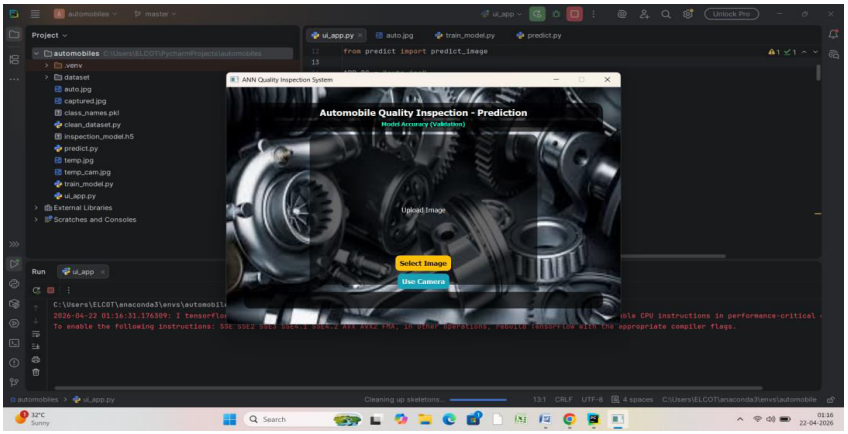


Fig.6

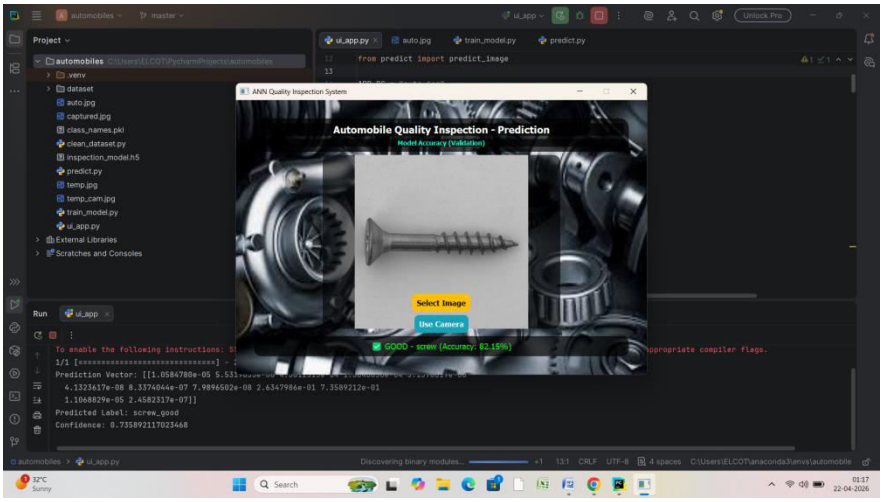


Fig.7

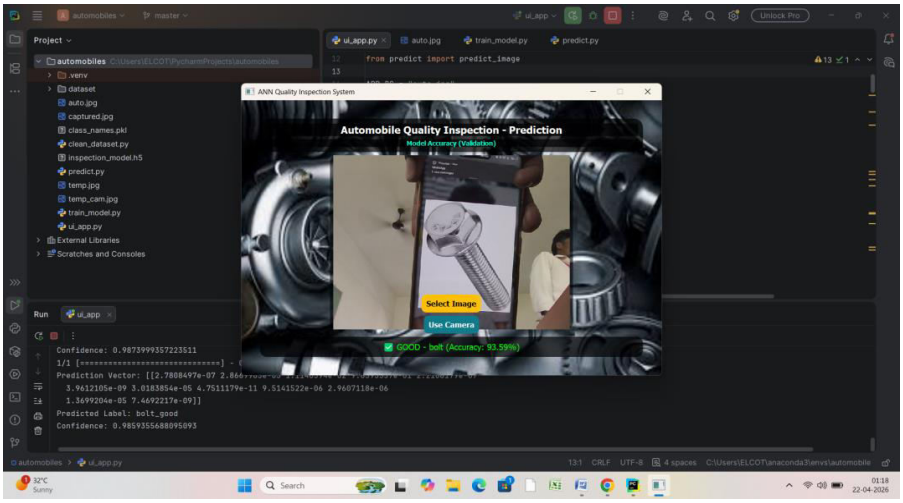


Fig.8

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Fig 2, Fig 3, Fig 4,Fig 5,Fig 6, Fig 7,Fig8,Fig9(System interface and processing results)
The system reduced inspection time and improved consistency, ensuring better quality control in manufacturing processes.

VI. CONCLUSION

The project titled "To Design an Artificial Neural Network Based Quality Inspection System for Automobile Components" successfully demonstrates the application of AI in industrial automation. The system effectively detects defects using image processing and neural network models.

By automating the inspection process, the system reduces human effort, increases accuracy, and enhances production efficiency. The integration of ANN ensures reliable and consistent results, making it highly suitable for automobile manufacturing industries.

Overall, the system provides a practical solution for improving quality control and minimizing defects in production environment processing efficiency, the proposed system offers a practical and scalable solution for modern document analysis. Overall, the project highlights the potential of AI-driven technologies in transforming traditional reading and information extraction methods into intelligent and automated processes.

VII. FUTUREWORK

- The system can be further enhanced by:
- Using advanced deep learning models like CNN for higher accuracy
- Expanding dataset for better training performance
- Implementing real-time video inspection
- Integrating IoT for smart manufacturing systems
- Developing a mobile-based monitoring application
- Enhancing defect classification into multiple categories
- Improving system scalability for large industries

REFERENCES

1. P. Viola and M. Jones, "Rapid Object Detection using a Boosted Cascade of Simple Features," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 23, no. 1, pp. 56–59, 2001.This paper introduced a fast and efficient method for real-time object detection.It laid the foundation for modern vision-based inspection systems.
2. Y. LeCun, Y. Bengio, and G. Hinton, "Deep Learning," Nature, vol. 521, pp. 436–444, 2015.This work explains the fundamentals of deep learning and neural networks.It supports the use of ANN for automated defect detection.
3. A. Krizhevsky, I. Sutskever, and G. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks," Advances in Neural Information Processing Systems, 2012.The paper demonstrated CNN superiority in image classification tasks. It inspires ANN-based visual inspection systems.
4. R. Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.This book provides comprehensive knowledge on image processing techniques.It is useful for preprocessing and feature extraction modules.
5. T. Ojala, M. Pietikäinen, and D. Harwood, "A Comparative Study of Texture Measures," Pattern Recognition, vol. 29, no. 1, pp. 51–59, 1996.This study discusses texture-based feature extraction methods.It is relevant for detecting surface defects in automobile components.
6. K. He, X. Zhang, S. Ren, and J. Sun, "Deep Residual Learning for Image Recognition," IEEE CVPR, 2016.This paper introduced deep residual networks for improved learning.It supports robust ANN training for defect classification.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details