COLLEGE CODE -3108
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DATE - 13-05-2025

Completed the project named as

PERFORMANCE OF THE PROJECT
QUALITY CONTROL IN MANUFACTURING

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Phase 4: Performance of the Project

Title: Quality Control in Manufacturing

The focus of Phase 4 is to reduce the surface defect rate in metal car body panels at AutoForm Industries to below 1% by identifying root causes of quality variation and implementing a data-driven quality control system. The initiative aims to optimize production through Statistical Process Control (SPC), Six Sigma methodologies, and computer vision-based defect detection. This will lead to enhanced product consistency, reduced waste, and improved overall production efficiency.

1. Production Workflow Analysis

Overview:

A detailed examination of the end-to-end manufacturing workflow will be conducted to identify where and why defects such as scratches, dents, and paint inconsistencies occur.

Performance Improvements:

Process Mapping: Comprehensive mapping of each stage-forming, handling, painting-will be used to locate sources of variation.

Root Cause Analysis: Using tools like fishbone diagrams and 5 Whys to pinpoint root causes of recurring defects.

Outcome:

The outcome will be a clear understanding of defect sources and actionable insights for process improvements.

2. Implementation of SPC and Six Sigma

Overview:

SPC techniques and Six Sigma principles will be used to monitor and control process variables that impact quality.

Key Enhancements:

Control Charts: Real-time monitoring to detect deviations from standard parameters.

DMAIC Framework: Define, Measure, Analyze, Improve, and Control will be applied to address high-defect areas.

Outcome:

This will reduce variation, improve consistency, and lower the defect rate significantly.

3. Computer Vision-Based Defect Detection

Overview:

AI-powered vision systems will be deployed to automatically detect surface anomalies during and after the production process.

Key Enhancements:

High-Resolution Imaging: Cameras capture real-time images of panels.

AI Detection Models: Machine learning models trained to classify defects with high accuracy.

Outcome:

Real-time, automated quality checks will drastically reduce human error and increase detection efficiency.

4. Performance Testing and Metrics Collection

Overview:

Key quality and efficiency metrics will be tracked throughout the project to ensure measurable improvements.

Implementation:

Defect Rate Tracking: Monitoring before and after implementation to quantify improvements.

Process Efficiency Metrics: Downtime, rework rates, and throughput will be analyzed.

Outcome:

Achieving a consistent defect rate below 1% and demonstrating enhanced process stability and productivity.

Key Challenges in Phase 4

1. Root Cause Identification:

Challenge: Complex interdependencies in the workflow make pinpointing causes difficult.

Solution: Use structured problem-solving tools and cross-functional teams.

2. Data Integration:

Challenge: Integrating sensor, visual, and manual inspection data for holistic analysis.

Solution: Develop a centralized quality control dashboard.

3. AI Model Accuracy:

Challenge: Ensuring defect detection models are reliable across varying lighting and surface conditions.

Solution: Train models with a large, diverse defect dataset.

Outcomes of Phase 4

1. Defect Reduction: Surface defects reduced to below 1%, cutting rework and scrap rates.

2. Enhanced Detection: Faster, more accurate defect identification using AI vision systems.

3. Improved Efficiency: Streamlined operations with reduced delays and higher throughput.

4. Data-Driven Insights: Continuous improvement enabled by actionable quality data.

SAMPLE CODE OUTPUT

Output

```
Process Capability (Cp): 1.33
Process Capability Index (Cpk): 1.33

=== Code Execution Successful ===
```

Output Clea

```
Simple defect detection accuracy: 100.00%

=== Code Execution Successful ===
```

Output

```
Mean: 0.8018
Standard Deviation: 0.0302
UCL: 0.8925
LCL: 0.7111

Control Violations (Index, Value):

=== Code Execution Successful ===
```