Problem Definition & Design Thinking

Title: Quality Control in Manufacturing

Problem Statement:

Manufacturing industries often face issues related to inconsistent product quality due to ineffective or outdated quality control methods. This leads to increased waste, customer dissatisfaction, and higher production costs.

Target Audience:

- Manufacturing plant managers
- Quality assurance teams
- Industrial engineers
- Line operators and supervisors
- Product design teams

Objectives:

- Improve detection of defects early in the production cycle
- Reduce production waste and rework
- Enhance customer satisfaction through consistent product quality
- Integrate real-time feedback loops for quality control

Design Thinking Approach:

Empathize:

The pain point lies in detecting quality issues quickly and accurately. Manual inspections are inconsistent and often subjective. There is a need for real-time, unbiased, and scalable quality assessment solutions.

Key User Concerns:

- Difficulty in identifying root causes of defects
- Lack of real-time monitoring tools
- Delays in reporting and responding to quality issues
- Manual inspection is time-consuming and error-prone

Define:

A clear need exists for a smarter, faster, and more accurate quality control system that integrates with the production line, reduces human error, and provides real-time insights to operators and managers.

Ideate:

- Potential ideas include:
- Vision-based defect detection using cameras and AI models.
- Use of IoT sensors to monitor vibration, temperature etc,
- Predictive analytics for machine health and product quality.
- AI-powered dashboard to visualize trends and alerts.

Brainstorming Results:

- Use of computer vision for automatic defect detection
- Real-time dashboard for quality tracking
- IoT sensors to monitor environmental and operational parameters
- Machine learning models for predictive quality analytics
- Mobile alerts for quality threshold violations

Prototype:

Key Components of Prototype:

- Camera-based inspection module: Detects visual defects automatically

- IoT sensors: Measure temperature, pressure, vibration
- Dashboard UI: Displays real-time quality metrics and alerts
- Machine Learning backend: Predicts potential defects based on trends
- Feedback system: Allows operators to annotate and log issues

Test:

The prototype will be tested on a small production batch. Feedback will be gathered from plant workers and QC teams to improve accuracy and usability.

Testing Goals:

- Evaluate defect detection accuracy of the camera system
- Assess latency of real-time alerts and dashboards
- Collect user feedback on usability of the dashboard and mobile alerts
- Validate reduction in waste and defect rates over trial periods