Implementing a Barcoding System to Error Proof Oil Dispensing System in the Engine Assembly Line

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Abstract—*Quality in engineering and manufacturing has a pragmatic interpretation as the non-inferiority or superiority. Maintaining quality is of vital importance for any industry. Imparting quality is a continuous process that involves proactive error detection and prevention. This project aims at developing and implementing an error proofing system in the engine assembly line. Any process that is subjected to human intervention is subjected to errors that can occur due to distraction, tiredness, cramped conditions etc. – to varying degrees. Eliminating the people from any production process is improbable. The changes in the production/sequence order changes due to one or many unforeseen circumstances can contribute to manual errors in the assembly line. The major ones being fitment of wrong engine parts, fitting the parts incorrectly and/or missing the parts completely. This project intends to implement an automation system to Error proof and ensure that required oil type and quantity are dispensed in accordance with the engine model -using a barcoding system*

Key words: - Automation, proactive error proofing, quality assurance, reducing manual errors, Traceability system.

I. Introduction

Humans are indispensable part of any manufacturing industry. And when human resource is involved chances of human errors cannot be dismissed. Almost all defects are caused by Human errors. There are basically ten kinds of human errors that are observed:

1. Forgetfulness
2. Errors due to misunderstanding
3. Errors in identification
4. Errors made by amateurs
5. Over confidence errors
6. Inadvertent errors
7. Errors due to slowness
8. Errors due to lack of standards
9. Surprise error
10. Intentional errors.

These errors are responsible for generation of almost all the defect. Shigeo Shingo distinguished between a mistake and a defect as: - (1) Mistakes are inevitable, people are human beings and cannot be expected to concentrate all the time on the work or to understand completely the instructions. (2) Defects results from allowing a mistake to reach at the customer end.

The goal of any Poka-yoke is to set the defect free process so that mistakes can be prevented or immediately deleted and corrected. Main areas where defect can takes place are:

1. Omitted processing
2. Processing error
3. Error in setting up work piece
4. Missing parts
5. Wrong parts
6. Processing wrong work piece
7. Adjustment error
8. Miss-operation
9. Equipment not set up properly
10. Tools and jigs improperly prepared

From the customer point of view one of the biggest mistakes that can happen in any manufacturing process is wrong details being printed on the product. This makes retracing the product or even lodging a complaint back to the manufacturer difficult. It can also lead to many complications. Confusion regarding the warranty coverage, repair or replacement costs etc... are just some of them.

The operation and running cost of nay manufacturing firm would shoot up immensely when the workers start using the resources in a way that is not standardized. Some of the engine parts used in the assembly line are customer specific. Engine oil filled in the oil sump being one of them. There are many different kinds of engine oils available in the market and their prices differ greatly from each other. In a general factory set up the staff has to read up the instruction manual and manually select the quality and quantity of oil to be filled in each engine. Fatigue and carelessness may lead to the selection of wrong oil type and quantity for wrong engines, leading to monetary loss for the organization and customer dissatisfaction

II. System Details

The occurrence of such non-conformances in the production line can be eliminated by introducing the concept of a barcoding system. A barcode uniquely encodes a large amount of data in a very small area. It employs a track and trace concept where, the product can be tracked with the unique barcode label and tracing is done through optical sensors called scanners.

The output of the barcode can be directly fed into the respective machine to minimize human intervention and thus the chances of occurrence of human errors.

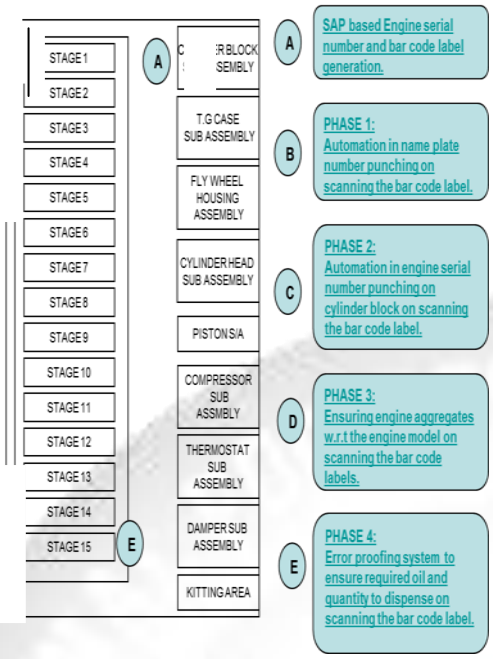

Fig. 1: Block diagram showing a typical engine assembly line and stages where automation of the oil dispending unit could be implemented

III. Pre Requisites

As a pre requisite to implying the error proofing system, the Engine serial numbers and barcode label are generated in the stipulated format. A 2D code or QR code is always preferred over a 1D code as it can hold more information than the former.

Since in most of the engine manufacturing units' associates work in shifts, it's highly advisable to have a preproduction order updated in the SAP team at the beginning of each shift. The barcodes could be accordingly printed based on this list.

Fig. 2: Difference between a 1D code (left) and 2D code (right)

IV. Automation System

Error proofing system to ensure required oil and quantity dispensed w.r.t engine model

A. Problem definition:Human errors due to fatigue or carelessness can lead toWrong oil type and quantity being filled into the oil sump at the oil dispensing stage. This will results in wastage and huge monetary loses for the organization

B. Root cause: The main reason for this problem is the manual triggering and selection of oil type and quantity at the oil dispensing stage. The current system requires an associate available at the work place to manually identify the quantity and type of oil to be filled on skills of observation of the color and size of oil sump. This may lead to some errors.

Solution: Bar code can be introduced to enable the automation of oil dispensing.

Block diagram representation of the solution:

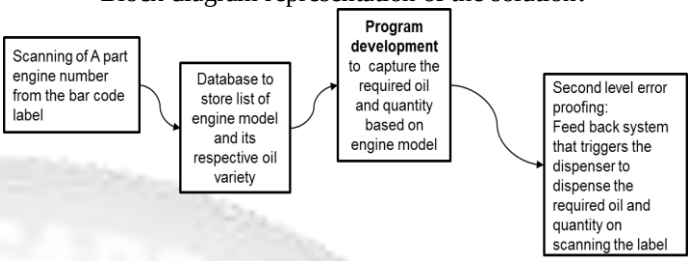

Fig. 3: block diagram showing the process flow for the automation of oil dispensing unit

C. Facility required for establishing the error proofing system:

- Program to interface barcode details with the Oil type and engine details to ensure correct selection.
- Wireless scanner to scan the barcode label.
- 7 segment display to show the details
- System/computer to load the program
- Oil dispensing station interfacing hardware
- A 2D barcode label with the engine Apart number

D. Detailed overview of the automation system

1. A thin client PC has to be made available near the cylinder head marking station. This thin client is in a VLAN (eWIS) and one particular PC in the PEP dept. is connected to this eWIS VLAN.
2. An application runs in the thin client PC which interfaces with the Oil dispensing station interface hardware (control hardware), barcode scanner and the internal database.
3. The database in this thin client is maintained by an application in the PEP PC connected to the eWIS VLAN.
4. After each scan, the A-Part number of the engine is segregated from the barcode data and the associated program number in the database is determined and the same is sent to the control hardware via RS232.
5. The control hardware consists of 12 potential free contacts and 12 indicators. The oil dispensing machine has 12 programs to choose from and perform the dispensing. The 12 potential free contacts in the control hardware are interfaced to the selection circuit of the 12 programs in the oil dispensing machine. The control hardware triggers the oil dispensing machine to automatically run the desired program as instructed by the application. Out of the 12 indicators the appropriate indicator glows to denote which program has been selected to run.

V. CIRCUIT DIAGRAMS

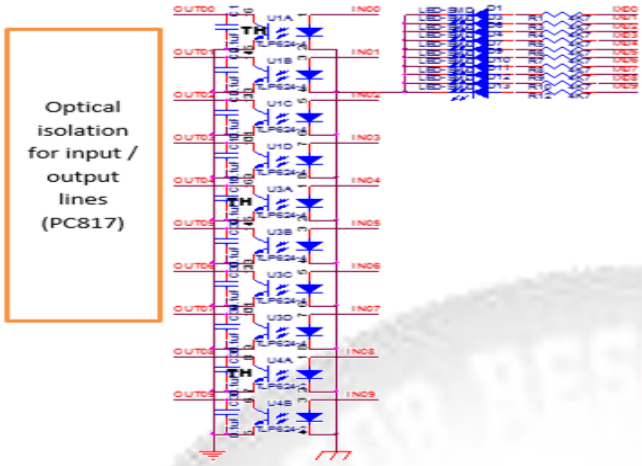

Fig4. Intermediary circuit and connections Circuit for optical isolation for I/O lines

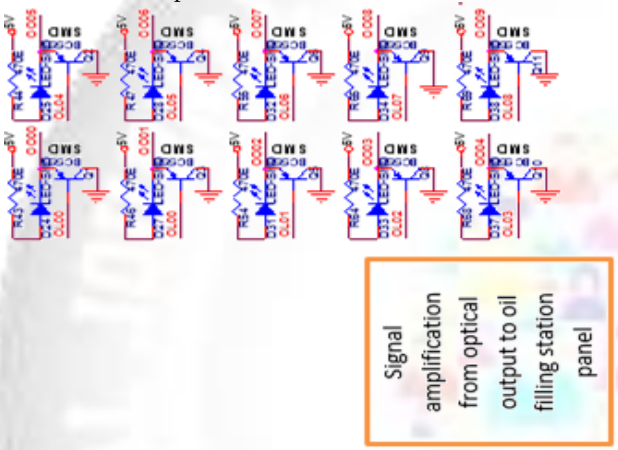

Fig. 5: Circuit for signal amplification from o/p to oil filling station panel

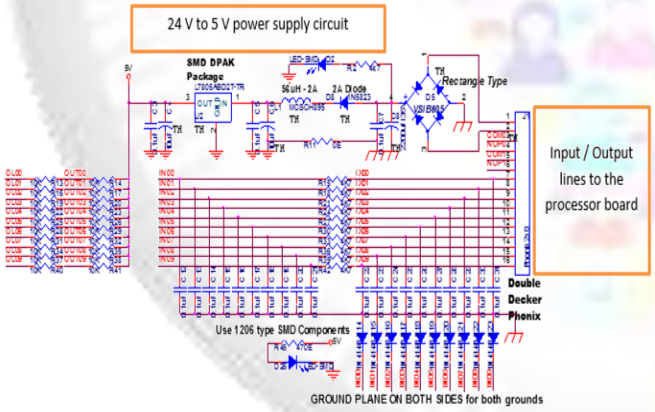

Fig. 6; Intermediary circuit showing power supply and I/O to the processor board

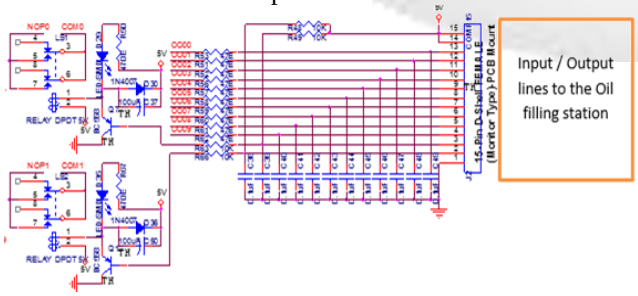

Fig. 6: Intermediary circuit and connections I/O to oil filling station

VI. SCOPE FOR FUTURE IMPROVEMENT

The current system requires a human resource to handle the barcode scanner and scan the label manually. Improvement and automation can be introduced to eliminate this human intervention as well. The scanner could be mounted/ fixed over a fixture to eliminate the need for a person to do the scanning

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