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APPLICATION OF POKA YOKE IN A MANUFACTURING ORGANIZATION: A CASE STUDY

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Abstract

Quality has become a great concern for the manufacturing environment in order to cope with the current scenario competition. For this purpose, manufacturing organizations are utilizing various tools and techniques. One of such tool is Poka-yoke. Poka-yoke is a tool for preventing the human errors in the manufacturing process. The present paper entails the basic concept of poka-yoke and its working. A case study has been presented to exhibit the application of poka-yoke in a manufacturing organization.

Keywords: *Poka-yoke, error, automation, quality*.

1. Introduction

In today's world quality is most important concern for any company as quality is the first priority of any costumer what he purchases. There are so many factors that can degrade the quality of any product or services. One main cause of this quality degradation is the human intervention in process which can lead to any error and make the product of wrong specification of undesired quality. To avoid this concern of error and degradation of quality mostly companies are using tool known as poka-yoke to remain competitive in the present scenario.

The poka yoke was first invented in 1960 by Shigeo Shingo for prevention of human errors. This is a Japanese technique of waste management. In poka-yoke we remove the errors by prevention, detection and awareness in the manufacturing industry. Prevention poka-yoke reduces the possibility of any kind of mistake in any process. Detection poka-yoke is used to detect the mistakes or errors that have already occurred in the process. Detection poka-yoke is the secondary poka-yoke and in manufacturing industries prevention poka-yoke is far better than the detection one.

Poka-yoke is an effective tool of lean manufacturing (Lean manufacturing is the process of waste management which maximize the value-added activities and eliminate the waste throughout the work). It is a mechanism which makes any process a mistake proof. This mechanism reduces the probability of occurring of mistakes by drawing attention of any equipment operator towards correct activity and default activity. In manufacturing industry, Poka-yoke is used world-wide and very effective in manufacturing operations and in assembly operations.

Poka (inadvertent errors) + yoke (to avoid) = Poka-yoke (mistake proofing)

Types of common human errors takes place in manufacturing are as follows:

- Lack of standardization
- Intentional errors
- Lack of identification
- Misunderstanding
- Forget fullness
- Fatigue occurs
- Social interaction
- Unexpected errors etc.

There are basically three types of Poka-yoke are as follows [1]:

- Contact method: Contact method identifies the part with the dimensions of the part and with any physical attribute like shape, size and colour of the part. This contact method includes proximity sensors and limit switch that helps to feed the part in correct orientation.
- Counting method: Counting type method is used when the operations performed in a process are fixed in number or the product has fixed number of components attached to the product. In this method a sensor will count the number of times the part is used and will leave the part when the number of counts will be right. In this an identification signal is generated that alert the operator on the line.
- Motion step method: Motion step used where an operator perform several activities instead of performing one activity multiple times. The devices can alert the operator whether any step is skipped or not if skipped the operator can't move to the next step.

3. Case study

In this section, a case study is presented for the application of Poka-yoke in a manufacturing industry. In this case study, wrong assembly of fuel tank cap in tractor is causing wrong product delivered to customer. The manufacturer wants to ensure correct fitting of fuel tank cap. The steps for poka-yoke are as follows:

3.1 Ideas after observation and brainstorming:

Carefully observe the process and put the problem on table for the brainstorming session. Following ideas are obtained for the problem-

- Use of photoelectric sensor
- Use of separate design of fuel tank cap
- Alarm light
- PLC

2. Steps to implement poka-yoke

The steps involved in poka-yoke are as follows [2]:

- Identify the problem
- Observation at workstation
- Brainstorming for idea
- Select best idea
- Implementation plan
- Implement
- Monitor and sign off

- Use of optical colour sensors
- Use of machine vision

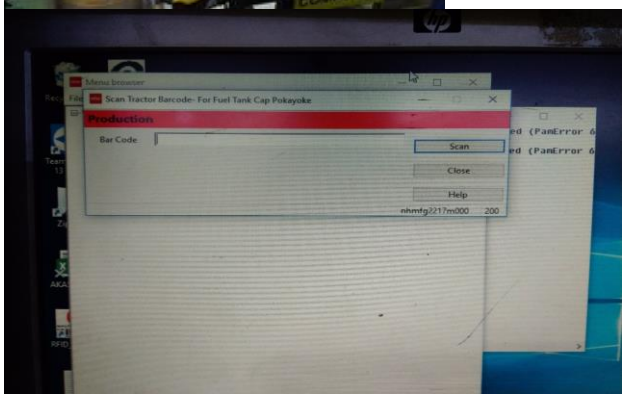
From the proper analysis of above ideas, the best suited idea to solve this problem is use of optical sensors. On basis of this idea requirements are being made by team and made an implementation plan. This system of poka-yoke uses shutdown method having following components:-

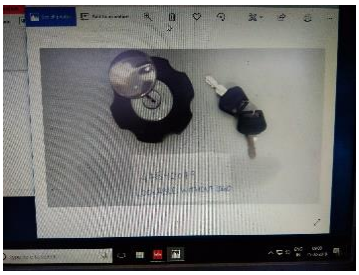
- Barcode scanner
- ERP
- Computer system
- Limit switch
- Optical sensor

This problem belongs to a tractor assembly line in which a conveyor line is using having fixtures to hold the tractor in right position. One tractor occupies two fixtures having a travel card in which all the tractor details are mentioned in the alphanumeric form and in barcode form. Below the conveyor line, limit switches is being provided. On one station of assembly line an activity of fuel tank cap is being done by operator in which no mistake proof system is there. The operator is doing the job by his/her experience. Human may cause error due to many reasons like fatigue, social interaction, bad intention etc.

3.2 Working of poka-yoke system:-

- Operator scans the barcode of tractor number with barcode scanner and gets the variant of tractor. These variant of tractors are stored in the database of ERP LN and barcode dialogue box shows the tractor no.





- As the operator press enter an image of right fuel tank cap is displayed on the screen of computer according to the variant of tractor. Hence it makes the operator to take the right cap what shown in the picture on screen. This type of system or method is called as control method.
- But there is a problem that if the computer sometime unable to show the image of fuel tank cap in that case what the operator will do. To overcome this problem team decided to use shutdown method which use limit switch, optical sensor, PLC and an alarm light.
- The process continues after barcode scanner that has been linked with the optical sensor and these sensors are connected with a microcontroller which makes interface between PLC and limit switches.
- There are two bins of fuel tank cap with two optical sensors of two colours red and green.
- When barcode scanner scans the barcode of tractor variant the optical sensor glow the light of that bin of which fuel tank cap is to use. The light we can set on dwell or until the operator picks the part the will not off.
- If the operator takes wrong fuel tank cap the siren will raise and the line will stop (The optical sensor will sends signal to the microcontroller which sends signal to PLC which sends signal to alarm light to raise siren and line will stop).
- Another thing is use of limit switch in which if the operator does not scan the barcode until the third fixture hits the limit switch. As the fixture hits the limit switch without getting job done the siren will raise and the line will stop.

  Hence with the use of some devices we can make a system mistake proof system.

4. Conclusion

Poka- yoke is a mistake proof mechanism developed by japan and is used world-wide today. In modern days so much importance is given to quality because today each and every customer wants a good product in terms of quality. Hence, to achieve better quality of the product industries must have acquire this good technique. Poka yoke provide 100% built in quality control with a reduced no. of rejects and less time spent on the operator's training.

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