An Automated Real Time Monitoring and Triggering of Failures during Manufacturing Process – Andon

Chidanand G[1], Gautami R Pyati[2], Lohit P[3], Prathibha Kiran[4]

[1]Electronics and Communication, AMC Engineering College, India

[2]Electronics and Communication, AMC Engineering College, India

[3]Electronics and Communication, AMC Engineering College, India

[4]Electronics and Communication, AMC Engineering College, India

ABSTRACT

The Andon system comes from the lean production management idea of Toyota's automobile manufacturing and is a tool for the lean management of the production process, which is widely used in the field of automobile manufacturing. The purpose of the application is to make the production smooth and improve the efficiency. This metronome program design based on the "security lights" ideas, through a clear station rhythm, to enhance the abnormal corresponding capacity of the production line and eliminate the instability of manual routing, the establishment of fast and transparent production management model, can effectively improve the production efficiency, increase production.

Keywords: Andon, Andon Device, Andon System.

I. INTRODUCTION

Andon is derived from the Japanese word for the paper lantern. Liker (2004) has stated that Andon is a term for a visual control system using an electric light board (or another signal device) hung in a factory so that worker can call for help and stop the line. Andon is originated from Toyota Production System and has been used in many Japanese and American manufacturing plants as an effective approach to improve product quality.

The Andon systems are very effective in making the real time monitoring of the production system. The Andon Boards works in tandem with Andon System connected with the machine in the shop floor. The Andon system gives status to the Andon Display boards on real time. The Display boards allow the operators, supervisors and the management executive to get the real understanding of the performance of the machines. It can be activated by an operator pulling a cord or pushing a button or it can be automatically activated by equipment when a problem is detected. Whether it be because of part shortage, equipment malfunction, or a safety concern, the point of Andon in manufacturing is to stop work so that the team can gather together and perform a real-time root cause analysis and quickly apply a solution. Once the problem is resolved and work continues, the occurrence is logged as part of a continuous improvement system. This information is then shown through lights, numbers, and sounds to alert others about the problems. Three colored lights (red, yellow, and green) are mounted on a pole by a work station with a switch to allow the operator to quickly change the status

if anything goes wrong. A blinking Andon is a sign color-coding which is red = stop and green = go (or running). Yellow may stand for not running at a rate, 'need help', or something similar. The organizational structure on the shop floor consists of small teams of four to five operators with one team leader. The operators do the actual work, and the team leader covers their bases. If someone has to take a break, the team leader keeps the line working. If there is an absence, the team leader covers it (and the team leader of the next team now assists two teams). If there is time available, the team leader takes care of little things including smaller maintenance issues. And, most importantly for our Andon, the team leader is the first responder to help an operator in trouble.

Most of the traditional Andon systems are based on PLC as the main controller and make the communication function come true. With the traditional manufacturing industry in the growing cost of processing, production profits are getting lower and lower, in order to improve the overall profit margin of the enterprise, the metronome system based on the idea of "Andon" is applied to modern production enterprises to improve the production efficiency effectively, optimize the enterprise management process, improve the production efficiency, increase the production and increase the logistics deliverability, is an effective tool for lean management, more convenient for lean management. The system in addition to the original field devices, relying on the server, LED screen and other means to achieve the production site equipment failure caused by stop line and on-site operation of the help information, timely warning. At the same time the system can record the equipment failure time, maintenance response time, equipment repair time, etc. for production management to provide data analysis basis, optimize staffing and so on. The main advantage of the Andon system is that it can provide a new and more effective way to reduce production line shutdown, strengthen the management of the production organization process, visualize the information, transfer fast, transparent process, manage the closed loop, and improve the production's organizational efficiency.

Andon system have a very deep research, has achieved fruitful results, such as embedded equipment, intelligent mobile terminal processing system Andon signal data, construct the wireless communication network through WI-FI, realize the statistics, display and distribution of data information.

II. Implementation

2.1 Problem Statement

When there was an incident or breakdown in any of the station, the associate had to go in search for help to specific team in order to inform the incident or breakdown in the line. In practical scenario, there's more than one station in a production line which increases the complexity in calling for help which increase the downtime and affect the quality of product hence results in low productivity. Thus, to avoid all these above described problems, we have come up with a system called Andon.

2.2 Proposed Method

In order to tackle the setback in calling for help an Andon web application is set up at the end of an production line which contains the information on different kinds of error that could occur at different stations in

that line. When an incident or breakdown occurs the operator can select the department and the type of error that has occurred on specific station and raise a ticket in the Andon web application.
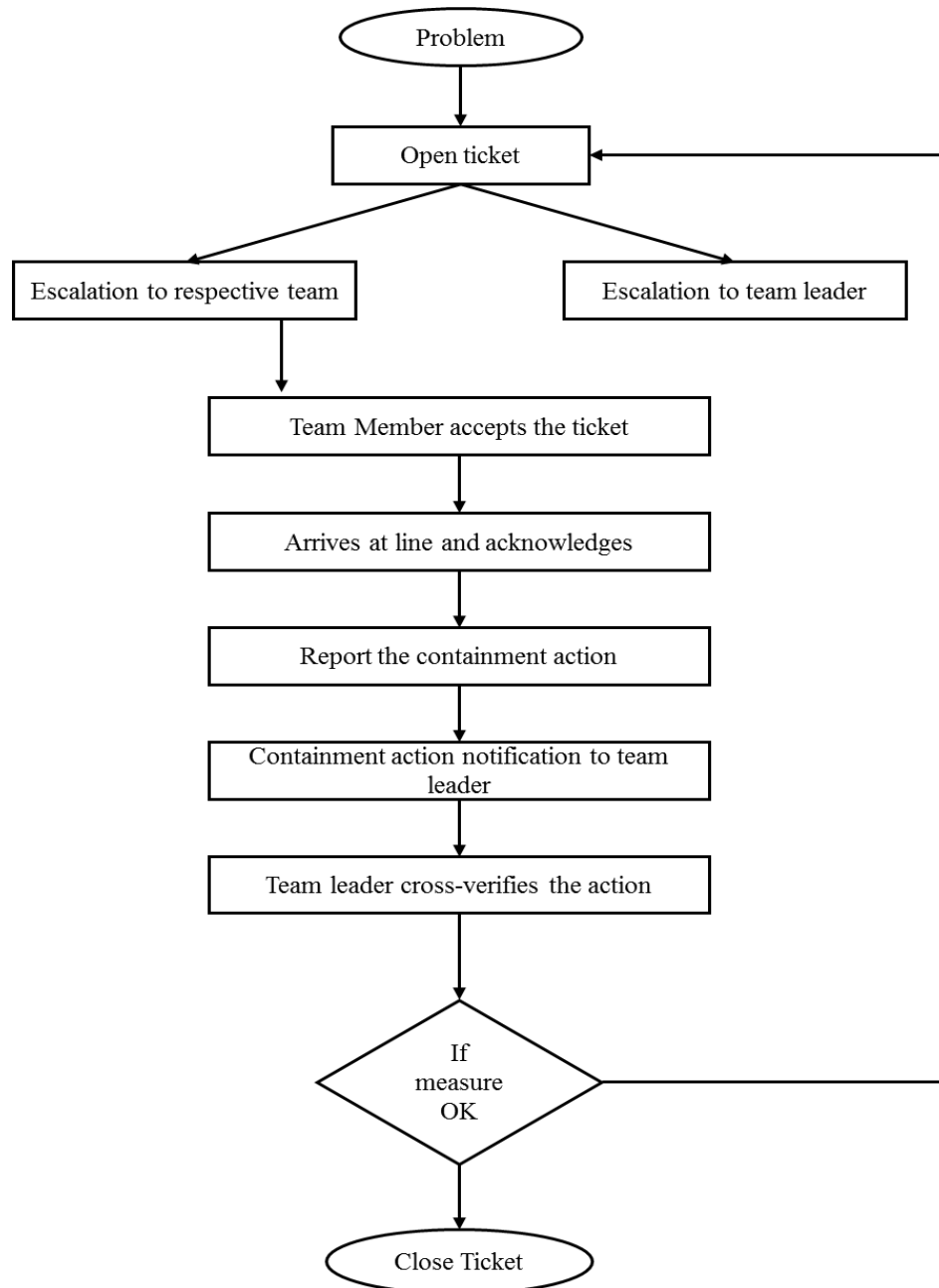

Fig.1 Process Flow

To provide quick reaction to the problem a smartphone loaded with Andon mobile application is given to the teams which provide solutions to the problem and to the team leader who looks after these production lines

Whenever a ticket is raised in the Andon web application an alert notification will be sent to the respective team ant the team leader about the issue, one person from the team will accept the problem and look into the problem. Once the problem is resolved the he enter the containment action he has taken in the mobile

application and an alert notification will be sent to the team leader about problem status. Team leader would then cross verify the containment action taken and close the ticket or re-assign the ticket if he is not satisfied with the problem. All the action taking place at each and every step is updated on the Andon web page. Andon system captures the time line of all the above mentioned process which can be used later to improve the response time and maintain a track on individual performance.

2.3 Andon Work Flow:

Step 1: The problem has occurred in the production line.

Step 2: The line operator raises the ticket in Andon web application (Operator view).

Step 3: Breakdown information is sent to respective team and team leader in Andon mobile application.

Step 4: A team member accepts the problem and moves to respective location.

Step 5: On arriving to the location the person acknowledges on the Andon web application and starts working on the problem.

Step 6: Once the problem is resolved he/she reports the containment action on Andon mobile application.

Step 7: Containment action is sent to team leader.

Step 8: The team leader goes to the location to cross check and acknowledge the measure.

Step 9: If the problem is resolved team leader closes the ticket if not a new ticket is raised.

Step 10: After resolving the issue ticket is closed and production is resumed.
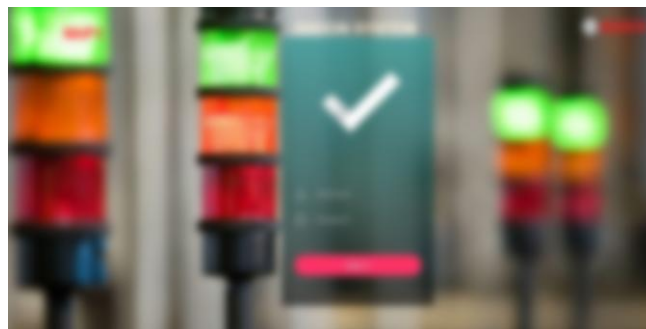
III. Result

Fig.2 Andon Login Page

The Andon web application has a common login page through which we can login to different production line. Providing different login to different lines helps in distinguishing data easily.

Once the operator login he/she can raise the ticket where he can select the responsible team, which station and the type of error that has occoured.
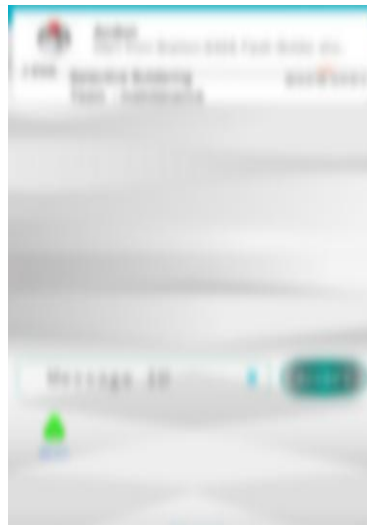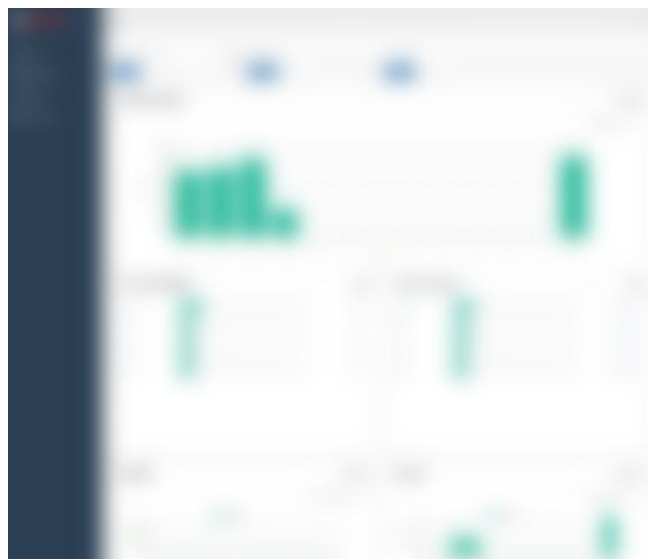
Fig.3 Andon Mobile Application

Fig.5 Andon Admin view

Once the ticket is raised parallel alert notification is sent to concerned team and to the team leader which can be view on Andon mobile application.
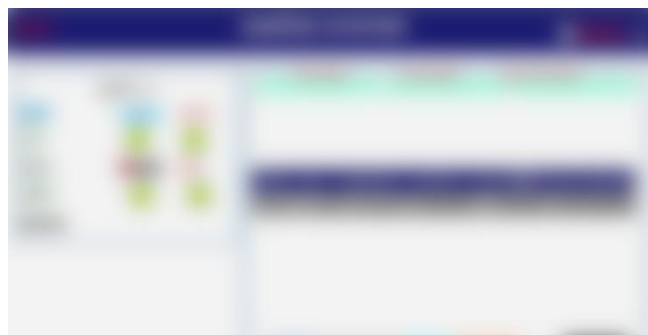

Fig.4 Andon Operator view

Fig.6 Andon Line view

All the data gathered from the production line is stored in a database which can be accesed by the management team for analysing the performance and take corrective action to increase productivity.

All the lines change their line status automatically by pulling data from the Andon web application and the line status can be seen on line view page which is visible for management team.

IV. Conclusion

In this project, we have introduced an automated real time monitoring and triggering of failures in manufacturing process which solves the problem of delayed response in addressing issues and also provides a better data collection solution. The results which have been mentioned above show how the proposed system is implemented in a production line and the various outputs of the system can be seen in above chapters. Here whenever a breakdown occurs the issue is raised and the message is sent to concerned person for quick reaction. The system uses different message transfer protocols to record data and quickly transfer the problem message to concerned person. Data gathered during this process can be used for real time monitoring of different production lines and address specific bugs that hinder production efficiency and quality of product.

V. Acknowledgment

REFERENCE

[1] Y. Monden, Toyota Production System: An Integrated Approach to JustIn-Time, 3rd Edition, Engineering & Management Press, Norcross, GA, 1997.

[2] J.K. Liker, The Toyota Way: 14 Management Principles from the World's Greastest Manufacturer, McGraw-Hill, New York, 2004.

[3] E. Mayne, T. Murphy and D. Winter, "Quality Crunch", WORD'S AutoWord, pp. 32-37, July, 2001.

[4] P. Strozniak, "Toyota Alters Faces of Production", Industrial Week, pp. 46-48, Aug. 13, 2001.

[5]   R.R. Inman, D.E. Blumenfeld, N. Huang and J. Li, "Designing Production Systems for Quality: Research Opportunities from an Automotive Industry Perspective", International Journal of Production Research, vol. 41, pp. 1953-1971, 2003.

[6]   C. Tierney, "Big Three Play Catch-up to Toyota Plant Prowess", Detroit News Special Report: Auto Plants: Battle to Be the Best, Feb. 22, 2004.

[7]   J. Li and D.E. Blumenfeld, "Quantitative Analysis of Transfer Production Lines with Andon", Report R&D-10001, General Motors Research & Development Center, Warren, MI, 2004.

[8]   Joshi S, Smith J. Computer control of flexible manufacturing systems. New York:Chapman & Hall Inc, 1994.

[9]   H.F. Li, J.T. Zhen, Y. Zhang, C. Lei. Design of medical wireless location network based on zigbee protocol. IET Conference Publications, 2007, pp. 709-712.

[10]   B. Zhang, G. Liu, B. Hu. The coordination of nodes in the Internet of Things. ICINA 2010-2010 International Conference on Information. Networking and Automation Proceedings. vol. 2, 2010, pp. V2299–V2302.

[11]   W. Chung, P. Hsiu, Y. Shih, A. Pang, Y. Huang, and K. Hung, "Mobility robust tree construction in ZigBee Wireless networks", in Proc. IEEE ICC, 2011, pp. 1-6.