

Process Monitoring System Based On Andon Using Arm Microcontroller

Roshan Roy¹, Nishikant Thatoi², Sanket Ghadge³, Hitendra Joshi⁴

¹ Student, Department Of Electronics And Communication, Institute Of Technology And Management, India.

² Student, Department Of Electronics And Communication, Institute Of Technology And Management, India.

³ Student, Department Of Electronics And Communication, Institute Of Technology And Management, India.

⁴ Asst. Professor, Department Of Electronics And Communication, Institute Of Technology And Management, India

Abstract: - This review paper presents the advantages of using ARM controller over PLC in andon system. This is an automation system based on ARM controller. It is a production monitoring system, giving real time update of the production line to the managers. Another feature of andon system is error reporting, it informs the line manager and technician of an error detected and its specific location. This allows the technicians and line manager to work on the error detected more efficiently and in less time.

Keywords: - Automation, Process Monitoring, ARM Controller, Touch Screen, GSM Module.

I. INTRODUCTION

The andon system, which is being used by a growing number of organisations for highlighting trouble areas within the production system. This review paper analyses the use of ARM controller as its controlling unit instead of PLC and how it can be beneficial.

History

The term “Andon” comes from an old Japanese word for paper lantern. An everyday example of an andon is the warning light on your car’s dashboard that indicates when the gas tank is getting close to empty. An andon system is one of the principal elements of the jidoka quality control method pioneered by Toyota as part of the Toyota production system and therefore now part of the lean approach.

Why Andon?

There may be a reverse “Boy who cried lion” condition. What happens if a worker pulls the andon to signal a need for help and nobody ever comes to the rescue? The employee stops wasting his time pulling that andon cord! In addition, if the cord is not pulled, the leadership team misses the opportunity to permanently fix the problem. Moreover, the lack of early warning means that there will likely be more frequent line stops.

Leader should always ensure that there is a response when required. Make the andon a source of information for you to drive continuous improvement. Andon boards has not only helped in reduction of “work in progress” or lag time between cycles, but has also helped organizations not to rely on white boards, clip boards, word of mouth and even email as a communication tool.

Benefits of using andon system

1. Makes the state and condition of manufacturing process easily accessible and very clear to everyone
2. It helps the industry guide, monitor and ensure productivity
3. Andon boards double as early warning devices
4. Andon boards can be used in manufacturing, inventory management, storage, receiving, picking and shipping.
5. It drastically reduces the time between an error being detected and it being repaired.

II. CURRENT SYSTEM

Andon is an old system created by Toyota, for quality improvement of their cars. It was latter adapted by lot of manufacturer for quality improvement and production monitoring. Since its inception, PLC has been used as its controlling unit. PLC was preferred over controllers due to it being highly reliable and because of its bulletproof nature. For input and for informing about an error cords were used. Lately buttons have replaced those andon cords. For visual information andon board and colour lamps were used, it was accompanied with buzzer for audio indication. The system PLC used big transmission wires for sending information. This ended

up making the whole system bulky consuming lot of space. The biggest disadvantage of using PLC was its cost. PLC normally cost a whole lot as initiation cost.

Block Diagram

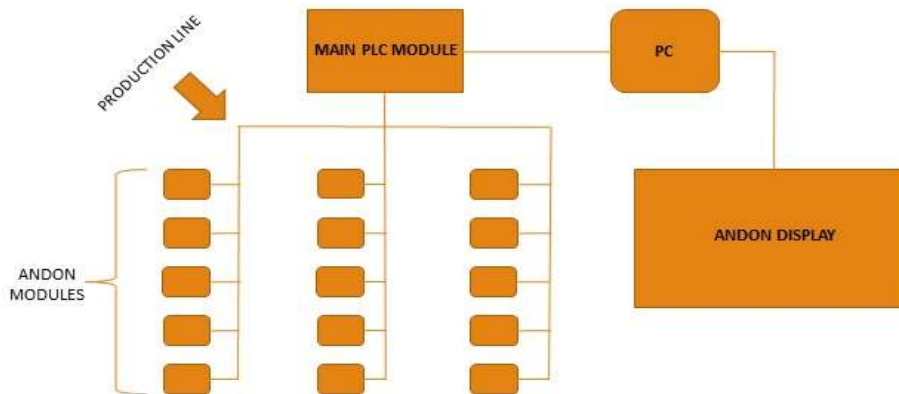


Fig. 1: Block diagram of the current system

Working

In the current system, Andon modules are laid out throughout the production line, with one andon module between three workstations as certified by the 6-sigma standards. Data from all the modules are combined and processed by the main PLC module. This combined data is send to a personal computer for storage of the processed data. The data is then to the andon board for displaying the data.

III. PROPOSED SYSTEM

We are trying to make a radical change by bring the old tested and proven system into new generation. We are replacing old cords and buttons with touch screen for better and easier interaction with the system. By adding GSM modem to the system, we are able to inform the technicians instantaneously about an error detected and give an overview of the same. The most radical change is the substitution of PLC with ARM controller in the system core. This allows the total cost of the system to be reduced by more than 70 %. By combining all these improvements what we get is an overall a much better and cost efficient system, not only are we able to reduce the cost we able to improve the quality of production along with proper real time update of the production lines.

Block Diagram

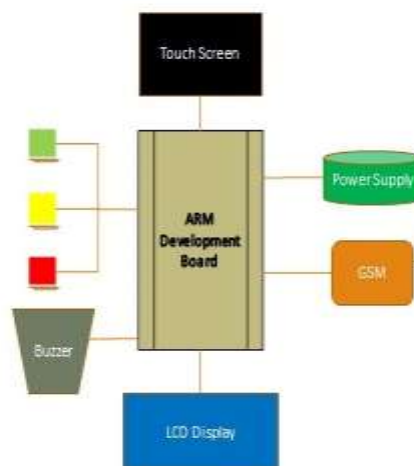


Fig. 2: Block diagram of the proposed system

Device Application

Touch Screen: - Touch screen acts as an input device for the system. It has three colour-coded inputs being Red, Yellow, and Green. Red signals stop (error) at that location, yellow signals intermediate stage (processing) and green signals start (process completed). It carries two other inputs, these inputs are user defined and can be set according to the needs. Example for these inputs can be shortage of equipment or object.

ARM development board: - ARM development board has ARM 7 at its core controlling the whole process. The development board is used for interfacing the whole system.

GSM: - GSM modem is used to send message to the technician, line manager and general manager if any error is detected along with the real time status of the production lines.

LCD display: - LCD display is used to graphically represent the status of the production lines, along with the status of the error detected with its location details.

Indication lights & Buzzer: - Indication light is a visual representation of the status of error. If any error is detected then red light is lit, if work on the error is on yellow light is lit and if the error is solved then green light is lit.

Buzzer is the audio representation for an error being detected.

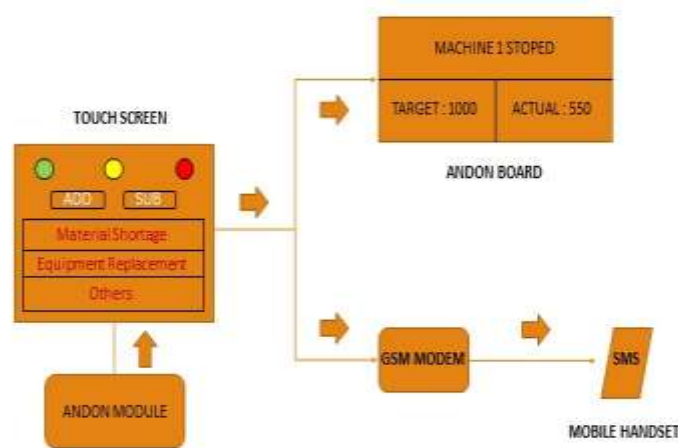


Fig 2: Visual process flow

IV. DIFFERENCE BETWEEN PLC AND MICROCONTROLLER

- PLC is mainly used for industrial applications, PLCs allow end user to organize and control the application which is more helpful in industries. Very complex controls and process like chemical industries requires more re-configurable controls.
- Microcontroller design would be suitable where end user need not modify the controls eg: Automatic washing machine.
- PLC programming is a type of graphical programming called ladder diagrams which are simple to understand, extremely easy and customized.
- Microcontrollers are programmed using either Assembly language or C language. Compared to Ladder Diagram these are much complicated.
- Trouble shooting is easier in PLC than microcontroller via online programming (we can see the real time working of PLC through computer).
- PLCs are electrically based controllers but Microcontrollers are electronics based.
- PLC module is costly as comparing with microcontroller, thus PLCs are commonly used in industries where as microcontrollers are applied in simple applications due its low cost.
- PLC are bulky and consume more space.
- PLC works on high power were as, Microcontrollers work on low power.
- PLC are very costly when compared to microcontrollers.

V. CONCLUSIONS

In this way we are able to get a much better system at a much cheaper rate. If we build this system using PLC at its core, it will cost us around RS 120,000/- , but by using ARM controller at its core we able to make the same system at under RS 10,000/-. With the proposed system not only can we bring down the system cost, but we can also make the system much more space efficient, less power consuming and easier for the operators to use. Thus replacing PLC with ARM in Andon system is a viable option.

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