

Fault Detection and Efficiency Analysis of Bottle Filling Plant

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ABSTRACT

Fault detection plays an important role in high cost and safety-critical processes. Early detection of process faults can help avoid abnormal event progression. Fault detection can be accomplished through various means. In this project by using proper sensor for each instrument we are going to detect the fault and ultimately try to increase the efficiency of particular plant. The sensors, micro-controller are key parts of the project. We mount separate sensor for each instrument to monitor performance of every instrument. The signals coming from the sensor are then fed to the micro-controller. We use Raspberry-pi micro-controller in this project. The micro-controller monitors all the signals coming from each sensor and according to that takes corrective action if a critical condition occurs. In this condition, the operator can see on his mobile app and control wherever he is. In this way the fault can be detected and the harm caused by any critical condition can be reduced. And it helps to increase the efficiency of the whole plant.

Keywords: Sensors, Fault, Efficiency, Raspberry-pi

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I. INTRODUCTION

In modern era in big industries specially in process industries where the accuracy and efficiency is important to achieve desired goal the fault detection system is arising and getting continuously upgraded day by day. In any process industries the fault is such a bug which creates unnecessary problems in continuous process which can lead to further loss in profit of that industry and degradation in instruments process. For example in process industries like in bottle filling plant all processes are dependent on each other like from starting of filling process to fulfilling of whole process each process is dependent on each other, now if a certain fault occurs in between the process the further process is disturbed because of the fault. Suppose as in above example of bottle filling plant if a fault occurs in conveyor belt which plays an important role in the whole process the further process depending on this will be disturbed and the whole process may get completely stopped. At the beginning detection of fault is limited up to certain parts of the process. It does not cover entire area of process. As the new technology came into action it was possible to detect the exact fault and exact location where the fault was occurring. The modern sensors, transmitters make it easy for operator to detect the fault and according to that helps him to take corrective action. Now a day's system is so upgraded that manual effort on detecting the fault and correcting it, is reduced. Now a day's Networking is

new emerging technology and is a revolutionary in the process of fault detection. Due to networking technology operator can monitor the various parameters of process where fault can occur

on the screen of monitor by sitting in his chair. Now it's not necessary for operator to go on regular check on running process the fault can be now detected automatically and can be seen on monitor or on android app. With the fault detection analysis of efficiency of plant is also important. The analysis of efficiency is necessary in all process industries so as to increase the product ability. Efficiency analysis is important to determine the day to day production that occurs in process industries. Efficiency analysis helps to match the level of desired production in a day to actual production in a day that occurs in industries. Efficiency analysis plays a vital role in the profit and loss of the specific industry. The purpose of the project is to detect the fault and thus calculate the efficiency of plant.

II. LITERATURE SURVEY

Process fault detection based on modeling and estimation methods:

The supervision of technical processes is the subject of increased development because of the increasing demands on reliability and safety. The use of process computers and microcomputers permits the application of methods which result in an earlier detection of process faults than is possible by conventional limit and trend checks. With the aid of process models, estimation and decision methods it

is possible to also monitor non measurable variables like process states, process parameters and characteristic quantities.

Distributed fault detection of wireless sensor networks:

Wireless Sensor Networks (WSNs) have become a new information collection and monitoring solution for a variety of applications. Faults occurring to sensor nodes are common due to the sensor device itself and the harsh environment where the sensor nodes are deployed. In order to ensure the network quality of service it is necessary for the WSN to be able to detect the faults and take actions to avoid further degradation of the service.

Fault detection of wireless sensor networks:

Distributed fault detection algorithm for wireless sensor networks. Faulty sensor nodes are identified based on comparisons between neighboring nodes and dissemination of the decision made at each node. Time redundancy is used to tolerate transient faults in sensing and communication. Simulation results show that sensor nodes with permanent faults are identified with high accuracy for a wide range of fault rates, while most of the transient faults are tolerated with negligible performance degradation.

A Survey of Fault Management in Wireless Sensor Networks:

Wireless sensor networks are resource-constrained self-organizing systems that are often deployed in inaccessible and inhospitable environments in order to collect data about some outside world phenomenon. For most sensor network applications, point-to-point reliability is not the main objective; instead, reliable event-of-interest delivery to the server needs to be guaranteed (possibly with a certain probability).

III. PROPOSED SYSTEM

In our proposed system the method of detection of fault and analysis of efficiency by various means such as to monitor all the parameters or monitor functioning of all instruments for proper output is composed. In this system quantitative efficiency of the bottle filling process is measured using an IR sensor pair. The IR sensor provides the pulsating output to the ESP8266 NODEMCU, thus the quantity of the bottle filled per hour is compared with the desired production rate of the bottle filling plant process. For the fault detection in bottle filling plant process we monitor different elements of the whole process which includes electric conveyer motor, electric water flow solenoid valves, IR sensor etc. For electric conveyer motor we used current sensor to measure the faults in the conveyer speed and detecting the jamming of the conveyer. For fluid flow electric solenoid valve we used the current sensor which monitors the electrical supply to the

solenoid valve ensuring fault prevention due to lack of electrical supply to the solenoid valve. To increases the efficiency and productivity of the bottle filling plant and to reduce the downtime of the process by 75%, we used combination of the current and voltage sensor to record real time data of the bottle filling plant. Using these two sensors we measured the power consumption of the whole plant. This data is then processed and monitor real time for any changes in power consumption. The power consumption of the process should be same for each product cycle which ensures the significance of healthy plant.

Sensor And Controller Network For Proposed System

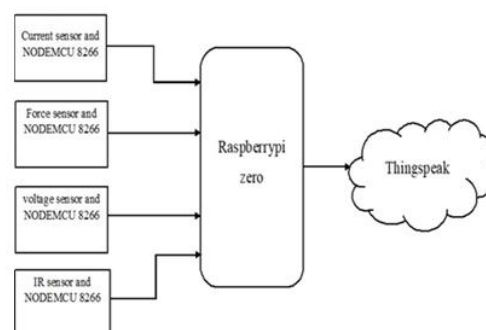


Fig 1:- Block diagram of proposed system.

Field Implementation and Sensor Placement in Bottle Filling Plant

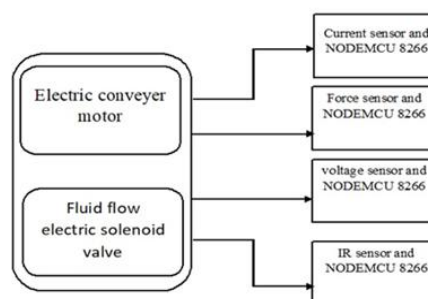


Fig 2:- Sensor placement block diagram for proposed system

IV. APPLICATION

- Bottle filling plant.
- Intelligent building.
- Food processing industries
- Manufacturing plant
- Packaging industries
- Petroleum industries

V. ADVANTAGES

- Any fault in the system can be detected quickly.

- The particular unit which is faulty can be identified.
- Efficiency of the plant can be monitored.
- Operator need not have to sit in operating room constantly.
- Reduce labor cost.

VI. CONCLUSION

The principle goal of this paper is detect the fault that occur in the continuous process in various plants and ultimately measure the efficiency and to increases it. This system will find the exact fault and exact location where it occurs, and help to operator to take corrective action immediately. The signals from recognized faults by sensors is send to the main micro-controller i.e. Raspberry-pi and further send to cloud or android app where operator can see it and accordingly takes action on it. This work will serve useful in the process industries, for example, in the process of bottle filling plant. It has numerous applications which incorporate process safety in various industries such as petroleum industries, food process industries, packaging and labelling, manufacturing plants etc.

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