Fabrication of Faulty Product Detection and Separation System

Mr. Shete Yogesh Shreekrushna
Self Employed
Renuka Services & Technology Pvt. Ltd., Akluj, India

Abstract—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 unfavorable environmental conditions 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 necessary actions to avoid further degradation of the network or the system. This paper presents a survey of various fault models developed for the fault detection and diagnosis. We discussed various fault detection techniques mainly focused on the areas of cooling, temperature and sensor readings respectively. We also discussed the diagnosis techniques required for the recovery of the fault in the network. In this project, the wireless networking system is used in the form of sensors for the purpose to find out the variation in the dimensions of the product. These variations are calculated by using Ultrasonic Distance Sensor and the data has been calculated or diagnosis has been done by using Arduino. The infrared proximity sensor is used to detect the exact location of metal product. Also a pneumatic actuator helps for the sorting of faulty products.

Keywords: Fault Detection Techniques

I. INTRODUCTION

All product manufacturing units need to have a faulty product detection and separation system in order to maintain product quality and maintain a good reputation. So here we demonstrate such a system using a mini conveyor belt system. We propose to design and fabricate a faulty product detection and separation mechanism. Each product is different and thus has different mechanisms to detect faulty products.

Here we detect faulty products based on product size. We use a sensor to detect each product height as products move over a conveyor belt. A defected product with height lower than minimum limit will be automatically detected as it moves on a conveyor belt and separated by a conveyor arm. Here we use rollers and rubber belt to develop a mini conveyor belt mechanism. This mechanism is operated by a motor. We use an ultrasonic sensor to detect product height and products with less than minimum height are detected as faulty products. The system uses a servo motor which has a separator arm.

In addition to these sensors, two more sensors are also been installed to determine the proper dimensions of the product undergoing inspection. One of these additional sensors is useful for lateral dimensions and another one is useful for transverse dimensions. Hence this will led to the accurate measure of component in all three dimensions.

II. LITERATURE REVIEW

Praveen Reddy, Samreen Kausar, Uppalpati Ramyashree Laxmi, Varadi Sahana [1] concluded with the assistance of Switchyard and transmission framework Automation we can improve dependability, Power Quality, and power taking care of and conveyance limit/the executives. The usage of computerization is exorbitant and complex strategy with expanding utilization of intensity hardware and gadgets gear, for execution in handily existing field.

Huizhong Song, Ming Dong, Rongjie Han, Fushuan Wen Md. Abdu Salam, Xiaogang Chen, Hua Fan and Jian Ye [2] concluded so as to deal with dubious components, including breaking down and other ill-advised activities of PRs and CBs, notwithstanding false as well as missing cautions, a shot obliged programming model is brought into power framework fault determination. The Monte Carlo reproduction based hereditary calculation is utilized to comprehend the created enhancement show. Moreover, the calculation speed of the created strategy meets the necessities of on-line fault finding applications.

Divyapradeepa T [3] concluded the utilization of PLCs (Programmable Logic Controllers) in substation and dispersion robotization applications has developed as of late. The financial aspects of plc based arrangement imply that substation mechanization and SCADA arrangement can be connected considerably more broadly.

Ing. Komi Agbesi, Felix Attuquaye Okai [4] concluded in end the proposed framework will give a decrease in the time required to find a fault via consequently giving exact fault area data. It will likewise permit administrators, for example, GRID to accurately identify and find faulted sections on their transmission lines and, accordingly, limit control disruptions to dissemination substations and help spare costly transformers.

Kunjin Chen, Caowei Huang, Jinliang He [5] concluded an assortment of techniques is presented and agent works are introduced in detail. Notwithstanding the traditional models, for example, ANN and SVM, we likewise present some encouraging new models developed of late. We propose the conceivable pattern for future works, including the use of models, for example, RBM and CNN. We likewise advanced the likelihood of utilizing the most recent AI models to encourage the fault location assignments.

Majid Jamil, Rajveer Singh, Sanjeev Kumar Sharma [6] concluded the structure of any electrical power dispersion framework regularly changes in view of the changing of burden designs, exchanging of intensity framework supplies, sudden separate of producing units, and so on. The proposed strategy is completely compelling in arranging every one of the ten sorts of issues and for any conceivable blend of various power framework parameters. The testing of the proposed technique under different working conditions, diverse fault opposition and fault origin edges, and correspondingly result got demonstrates that the outcomes are acceptable.

Divyapradeepa T [7] The utilization of PLCs (Programmable Logic Controllers) in substation and dispersion robotization application has developed as of late.
The financial aspects of plc based arrangement imply that substation mechanization and SCADA arrangement can be connected considerably more broadly.

Ing. Komi Agbesi, Felix Attuquaye Okai [8] In end the proposed framework will give a decrease in the time required to find a fault via consequently giving exact fault area data. It will likewise permit administrators, for example, GRID to accurately identify and find faulted sections on their transmission lines and, accordingly, limit control desruptions to dissemination substations and help spare costly transformers.

C. Fortunato, A. Casaca, A. Grilo and M. Santos [9] In the proposed methodology, the obtained current signs, hotspots pictures signs and interruption recognition pictures are transmitted to the SCADA System. To recognize the flawed task it will be utilized the program to identify the towers in which the deficiencies exist. This Project can likewise be incorporated into the Distribution Automation (DA), which is a key part of the keen network. The sensors, then again, could transmit the signs of fault area so as to address it by means of the switch in MV blended systems.

M. M. Ahmed [10] this exploration advances staff productivity by conveying staff to on location area just when essential. The working framework depicted here can decrease the quantity of blackouts and isolate the clients influenced by the shortcomings from the individuals who are not influenced the fault blackouts. In any case, clients still experience a momentary blackout amid the low side and high side checking until the suitable exchanging capacities are enacted and the fault area is to be actually recognized.

Ravi V. Ghodchar and Dr. R.G.Karandikar [11] wavelet based strategy is best for the investigation of L-L-L fault, DL-G fault can’t be recognized by it. The technique including DWT alongside the SVM gives lesser productivity of L-L-L fault recognizable proof; still it gives high precision for different sorts of fault. Accordingly we infer that this strategy is most fitting one for transmission line fault discovery and grouping.

M. M. Mansour, Mohamed, A. A. Wahab , Wael M. Soliman [12]. The proposed strategy can be connected on expansive power age station through building Petri net model for each segment. In addition it can manage mis-tasks of the circuit Breakers.

III. NEED OF MECHANISM
Detection of fault in the product is one of the major problems as it plays vital role in maintaining the quality of the product. Even a slight change in the size or shape of the product can change the configuration of the product and that lead to malfunction of the product. In automation manufacturing the process is handled by the computer or some controller. The entire product is manufactured and packet on the production line and stored. Here we talk about the application. To detect a problem on the production line is difficult as the process is automatic. Due to this the product manufactured can be defective and can fail during the operation. Due to this when the product reaches to the customers it fail to work which can lead to replacement of the product which is time consuming as the interchanging of the product is between two relative products but that can lead to testing of all products manually.

IV. OBJECTIVES
- To eliminate the excessive time required for testing the product.
- To maintain the quality of testing work.
- To reduce man power.
- To improve productivity of the plant.

V. MODEL DESIGN
This project attempts to review and study the feasibility of implementation of the automation and improvement of the quality of product with accurate measurement and testing phenomenon. Here we are going to use anulino programmed as per the required operation. Simply in this project, there is electronic programmed controller which is useful to operate an ultrasonic sensor. The controller has to be programmed as it can detect the variation in the size with the preset size and then made a decision in the form of Acceptance or Rejected product. If there is any size variation occurs during checking process, the controller has a program to operate pneumatic hammer. This pneumatic hammer punches the product and threw it away in to the rejected lot.

VI. EXPERIMENTAL SETUP
The process starts after the production line. A conveyer belt is placed before packaging which test the product for any fault in the product. The conveyer is design according to the need of the applications. The product from the production line travels on the conveyer belt toward the testing area. There is an ultrasonic sensor to measure the distance between product and the testing area so that the product
stops exactly below the sensor for the testing. When the product reaches in the testing area the ultrasonic sensor sends signal to the controller which in turn slows down the conveyer and stops it when it reaches under the sensors. When the conveyer stop the IR sensor check the size and shape of the product as programmed. If any fault in shape and size the products is removed from the conveyer belt and send for modification. If the product passes the IR sensor test it is moved a little forward so that it can go under the PIR sensor test. When the product comes under this test, it is already placed in such a way that its key side is near servo motor. The servo motor is used to turn the key of the lock so that operation of the lock is tested. If the lock passes this test it is send for packaging. If the product fails then it is send for modification or if modification is not possible it can be used as raw material.

Due to this the time required to check the product manually is reduced and the quality of the product is maintained. For such we require lots of coding and programming the sensors need to be programmed according to the requirement of the application. The speed of the servo motor is to be controlled so that it does not apply jerk on the product during stopping or starting. The servo motor used to unlock the lock is to be programmed so that it does not disturb the position of the product and the motor should turn only to the required angle so that the lock should operate. The ultrasonic sensor is programmed such that it measure the distance of the product so that it can send signal to the controller. Due to signal the servo motor used to move the conveyer is controlled that is its speed is controlled according the programming given.

In addition to these all, there are two more IR sensor are programmed in the sense that they will analyze the component for other dimensional details. The transverse dimensional sensor will help to analyze the dimensions in the form of Width. Also lateral dimensioning has been done with the help of third sensor. So with the help of all these three sensors, height, width, and length can be measured easily.

VII. COMPONENTS

A. Conveyor Belt:
The conveyer belt is modified as per the requirement of the applications as in this case we require a conveyer such that it can accommodate the lock such that its key side is exactly at the side of motor to test the working of the lock. All the sensors are placed exactly where required and a side base is provided so that if the lock does not pass the test it can separate for changes or modification.

B. Infrared Sensor
An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. This type of sensors measures only infrared radiation, rather than emitting the radiations. That is why called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

The IR sensor has two set of LED which is used to sense the obstacle. The two set of LED are IR Transmitter and IR Receiver. The transmitter transmits the light which travels for a fixed distance and get vanish when no obstacle or object is in the range. If an object or obstacle is in the range the transmitted light gets reflected and sense by the receiver LED. Due to such phenomenon we can test the size or shape of the object or in this case pad lock. By arranging a required amount of IR sensors at required place and direction one can measure shape and size of the object.
C. Ultrasonic Sensor

Ultrasonic sensors are used to detect the presence of targets and to measure the distance to targets in many robotized processing plants and process plants. Sensors with an ON or OFF digital output are available for detecting the presence of objects and sensors with an analog output which changes relatively to the sensor to target separation distance are commercially available.

![Ultrasonic Sensor](image)

**Fig. 5: Ultrasonic Sensor**

Ultrasonic obstacle sensor consists of a set of ultrasonic receiver and transmitter which operate at the same frequency. The point when the something moves in the zone secured the circuit’s fine offset is aggravated and the buzzer/alarm is triggered. The sensor detects objects by emitting a short ultrasonic burst and then listening for the echo. Under control of a host microcontroller, the sensor emits a short 40 KHz explosion. This explosion ventures or travels through the air, hits an article and after that bounces once again to the sensor. The sensor provides an output pulse to the host that will terminate when the echo is detected; hence the width of one pulse to the next is taken into calculation by a program to provide result in distance of the object.

D. Arduino Board

Arduino is an open source microcontroller which can be easily programmed, erased, and reprogrammed at any instant of time. Introduced in 2005 the Arduino platform was designed to provide an inexpensive and easy way for hobbyists, students, and professionals to create devices that interact with their environment using sensors and actuators. Based on simple microcontroller boards, it is an open source computing platform that is used for constructing and programming electronic devices. It is also capable of acting as a mini computer just like other microcontrollers by taking inputs and controlling the outputs for a variety of electronics devices. It is also capable of receiving and sending information over the internet with the help of various Arduino shields.

![Arduino Board](image)

**Fig. 6: Arduino Board**

E. Servomotor

A servomotor is a closed loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft. The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.

The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models.

F. Pneumatic Actuator

![Pneumatic Actuator](image)

**Fig. 8: Pneumatic Actuator**
A Pneumatic actuator mainly consists of a piston or a diaphragm which develops the motive power. It keeps the air in the upper portion of the cylinder, allowing air pressure to force the diaphragm or piston to move the valve stem or rotate the valve control element. In this mechanism, pneumatic actuator placed as a separator which is programmed such a way that it extends only when faulty product detected. The extended rod of actuator hits the component and helps to put it out from the packaging line.

VIII. EXPERIMENTAL VALIDATION

As of the model is based on the electronics programming, most of the processes are go through the automation. After building the model, we gone for the testing as follows.

A. Inspection / Testing procedure:

B. Results & Validation:

As the procedure follows for the testing of the Mechanism, we have found results as follows,

IX. CONCLUSIONS

- The performance of the system both in the presence and absence of the faults is an important task to be focused and ensured. This can be achieved by using the IOT devices in the data centers.
- Sensors in the data centers are the IOT devices for monitoring the environment and other sources.
- FDD is the basic technique to identify and diagnose the faults detected for these sensors due to some network load, external environmental conditions, and the internal damage of the system.
- As we have seen in results, the sensors are working well even in presence of the faulty products or components.
- The excitation of pneumatic actuator provides enough force to shot away the fault product as per the design.
- The use of three ultrasonic sensors gives satisfactory result while recording the data regarding to the all three dimensions length, height, and width. So this improves an accuracy of the system.

REFERENCES

[1] "Obstacle Detection Sensors: A Survey" Sachin Lalar
Department of Computer Science & Engg, TERI, Kurukshetra, India Accepted 20 December 2013, Available online 31 December 2013, Vol.3, No.5 (December 2013).

[2] "Motion Detection Using PIR Sensor" Yogesh Pawar, Abhay Chopde, Mandar Nandre Department of Electronics Engineering, Vishwakarma Institute of Technology, Pune.

[3] "Ultrasonic Distance Meter" Pawar Priti Arun, Mane Anjali Sudhakar, Pawar Megha Sunil, Sawant Shital Balaji Department of Electronics & Tele-
Communication Engineering SVERI's College of Engineering, Pandharpur Academic Year: 2014 – 2015.

[4] "Robot Arm Control with Arduino" by Aiman Mohamed Ahmed Ghiet Spring 2017.

[5] "Working Principle of Arduino and using it as a Tool for Study and Research" Leo Louis, Department of Electronics and Communication Engineering, Gujarat Technological University, Ahmadabad, India.

[6] “Fault detection and recovery in wireless sensor networks using clustering”, Abolfazl Akbari¹, Arash Dana², Ahmad Khademzadeh³ and Neda Beikmahdavi⁴.

[7] “A framework for wireless sensor networks fault rectification”, Ahmad Habouš¹, Mihir Narayan Mohanty², Binod Kumar Pattanayak¹* and Motassem Al-Tarazi⁴.

[8] “Sensor faults: detection methods and prevalence in real-world datasets”, Abhishek B. Sharma, Leana Golubchik, And Ramesh Govindan University of Southern California.

[9] V. Venkatasubramanian, R. Rengaswamy, S. N. Kavuri and K. Yin, “A review of process fault detection and diagnosis Part I: Quantitative model-based methods”, Computers and Chemical Engineering, No. 27, 2003, pp. 293-311.

[10] V. Venkatasubramanian, R. Rengaswamy and S. N. Kavuri, “A review of process fault detection and diagnosis Part II: Qualitative models and search strategies”, Computers and Chemical Engineering, No. 27, 2003, pp. 313-326.

[11] R. Isermann, “Model-Based Fault Detection And Diagnosis-Status And Applications”, Annual Reviews in Control, Vol. 29, Is. 1, 2005.

[12] R. Isermann, "Process Fault Detection Based on Modeling and Estimation Methods—A Survey", Automatica, Vol. 20, No. 4, 1984.

[13] Castillo and T. Edgar, "Model Based Fault Detection and Diagnosis,” TWCCC Conference, Spring 2008, Austin, Texas.

[14] P. M. Frank, “Fault Diagnosis in Dynamic Systems Using Analytical and Knowledge-based Redundancy, A Survey and Some New Results”, Automatica, Vol. 26, No. 3, pp. 459-474, 1990, UK.

[15] S. Katipamula and M. R. Brambley, “Methods for Fault Detection, Diagnostics, and Prognostics for Building Systems – A Review, Part I”, HVAC&R Research, Vol. 11, No. 1, January 2005.

[16] S. Katipamula and M. R. Brambley, “Methods for Fault Detection, Diagnostics, and Prognostics for Building Systems – A Review, Part II”, HVAC&R Research, Vol. 11, No. 2, April 2005.