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Faulty Lock Detection and Separation System

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ABSTRACT

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 conveyer 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 fault in lock based on its size and operations. We use a sensor to detect each lock size and operations as products move over a conveyer belt. The conveyer is design so that it can hold the lock so that it does not fall or leave the conveyer belt. A defected product with size lower than minimum limit will be automatically detected as it moves on a conveyer belt and separated by a conveyer arm. If the product passes the size test the next sensor perform it task to operate the lock so that it can open the locking mechanism and check if it opens or not. If the product passes the test it is send for packaging and if not the product is separated and sent to production line for correct the fault. Here we use rollers and rubber belt to develop a mini conveyer belt mechanism. This mechanism is operated by a motor. This system uses servo motor arm to separate the faulty product.

Keywords*:* Fault detection, Sensors, Motors, Fabrications.

I. INTRODUCTION

Quality maintenances are one of the important aspects of manufacturing a product. To maintain the quality there must be high class equipment and skilled worker are required. But in doing so cost of product goes high that can lead to loss to the company. To overcome such problem quality department is set in every manufacturing department. The work of this department is to test the quality of the product after it is manufactured. In automated manufacturing process the product is manufactured and packed on the same line. The quality of product may be of many types depending on the type of product. If the product does not meet the requirement of the product then it is consider as there is some fault in the product. The fault can be of size, height, shape, weight, operation, etc.

Fault detection is the process in which the faulty product is identified and separated from the set so that it can be used as raw material or can be sent back to production line for improvement. Detection of fault can be done by many methods like batch testing, one-by-one testing or testing of the product on the production manually. All this methods is time consuming and require human resources. In this we use lock as our product for detection of fault.

Problem statement

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 lock as our application. To detect a problem on the production line is difficult as the process is automatic. Due to this the lock manufactured can be defective and can fail to lock the door or where it is used to lock the facilities. Some time in mass production the key for the lock is fitted with different key due to this the lock fail to work. 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 key is between two lock but that can lead to testing of all lock manually. Sometime during manufacturing in the key there is a wrong cut made which tends to fail to work thus lock does not work.

Objective

The main objective of our project is to eliminate the time consumed in testing the product and to eliminate the process of correcting the mistake. For this project we use Arduino controller, IR sensor, Ultrasonic sensor, PIR sensor and servo motor to test the product. We use ultrasonic sensor so that the product can stop exactly below the IR sensor for testing. The PIR sensor senses the movement of the product. The servo motor is used to run the conveyer belt. Using this entire instrument, the product in this case lock, we can test its size, shape and working automatically so the there is no need of any testing department or any extra human resourced to test the product.

II. Methodology

To complete this project we are going to use different sensors to check or compare the standard set for the specific product or in this case a lock, the specifications like size of the lock, height of the lock, shape of the lock and a ultrasonic sensor is used to measure the distance so that the product is stop just below the sensor to calibrate the product. For making all sensors to work a controller is required and in this case we use Arduino controller. The entire sensor is connected using Arduino controller and a programming is required so that the entire sensor work properly and in sequence. To perform mechanical operation like moving the product servo motor with conveyer belt is used. In this case two servo motor are used, the second motor is used to control the operation of lock as set.

III. Working

A simple block diagram describes the project, in this we have use a set of sensors which is placed just before the servo motor. The entire setup is fixed on a frame of conveyer. This block diagram is just for reference as we have built our own setup for our application purpose. This block is a common as it can be used for any application based on modifications.

The main purpose of our project is to eliminate the time required to test the Pad lock during quality testing. For doing so we have built our own conveyer belt to carry the lock to the sensor position so that test can be performed. Our conveyer is simple as it uses a conveyer belt and a conveyer motor to operate the motor.

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 sensor are placed exactly where required and a side base is provided so that if the lock does not pass the test it can be separated for changes or modification. All the sensors which are used in this project are explaind below.

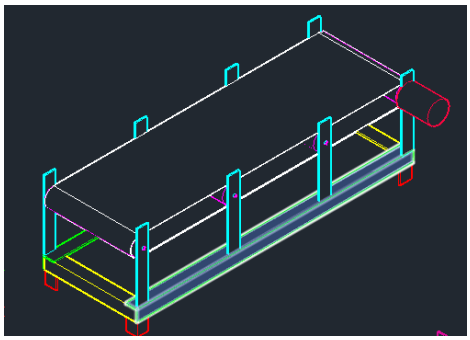

Figure 1. Conveyer.

IR 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. These types of sensors measures only infrared radiation, rather than emitting it that is 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.

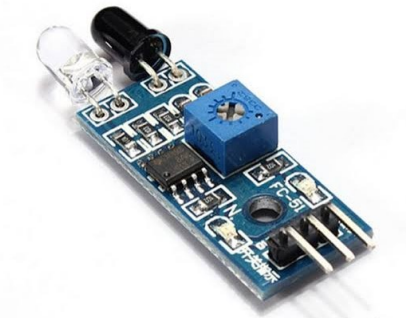

Figure 2. IR Sensor

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.

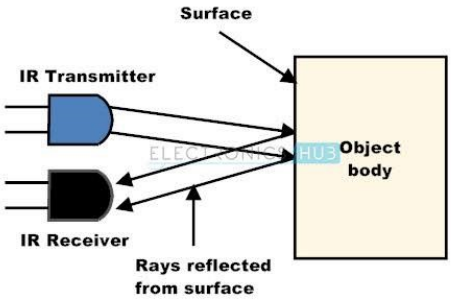

Figure 3. Working of IR Sensors.

PIR Sensors:- PIR sensors are more complicated than many of the other sensors because there are multiple variables that affect the sensors input and output. The PIR sensor itself has two slots in it each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

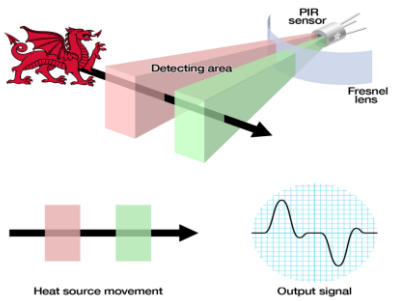

Figure 4. Working of PIR Sensor

When there is movement around the PIR sensor it is detected and data is send to the receiver end which performs the specific task as assign to the system.

Figure 5. PIR Sensor.

Ultrasonic Sensors:- 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.

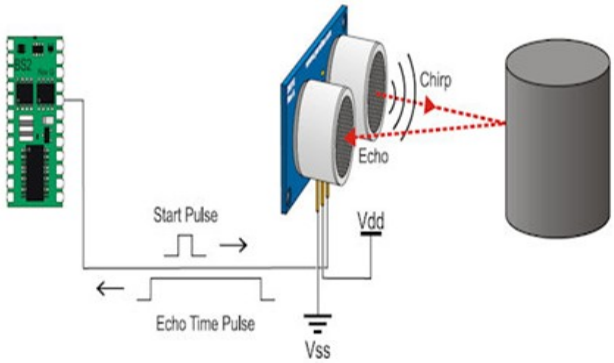

Figure 6. Working of Ultrasonic Sensor.

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.

Figure 7. Ultrasonic Sensor

The sensor detects objects by emitting a short ultrasonic burst and then listening for the eco. 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.

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.

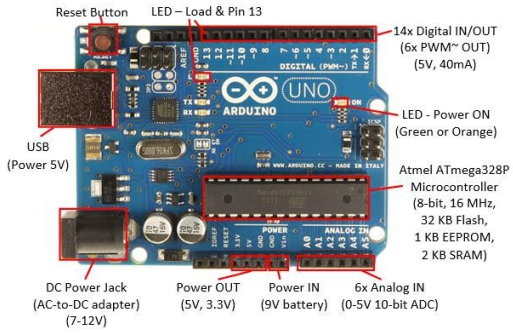

Figure 8. Arduino Board.

NEED FOR ARDUINO

A group of people using a similar product can hold posted message conversations and share their experiences or solve the problems of the other users in the communities with their own experiences. "If you start charging for everything, everything dies very quickly." says Banzi, Arduino Cofounder.

Arduino was developed with intent to provide an economical and trouble-free way for hobbyists, students and professionals to build devices that interact with their situation using sensors and actuators. This makes it perfect for newcomers to get started quickly.

Since Arduino is an open source platform the software is not purchased and only the cost of buying the board or its parts is incurred, thus making it very cheap. The hardware designs are also available online for free from its official website.

To make Arduino board function easy and also making it available everywhere these boards come with a USB cable for power requirements as well as functioning as a programmer.

The Arduino IDE is capable of running on a number of platforms including Microsoft, Linux and Mac OS X making the user community even larger.

The Arduino Development Board consists of many components that together makes it work. Here are some of those main component blocks that help in its functioning:

Microcontroller, External Power Supply, USB plug, Internal Programmer, Analog Pins, Digital I/O, Pins Power, GND Pins

IV. EXPERIMENTAL VALIDATION

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.

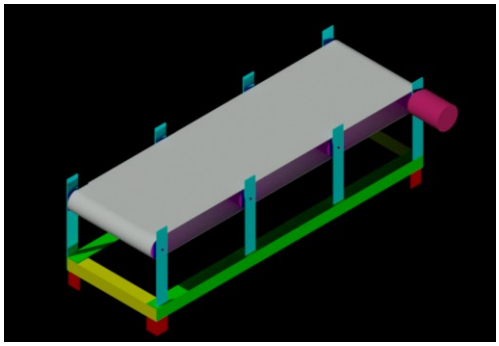

Figure 9. Conveyer belt with motor attached.

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 that signal the servo motor used to move the conveyer is controlled that is it speed is controlled according the programming given.

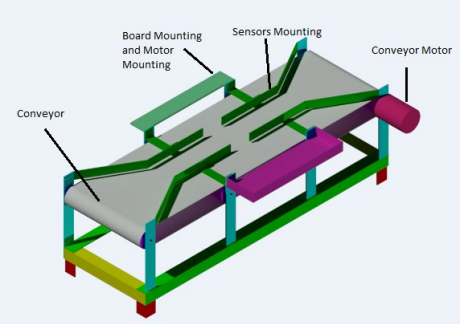

Figure10. Conveyer Belt with separation tray.

The above figure shows the arrangement of conveyer belt which include separation tray, conveyer motor and mounting for the controller.

V. CONCLUSION

From this it is clear that after a survey and research the problem faced by the company of quality maintenance and time saving both cannot be done on the same page. To do so there is need to invest in human resource, but that too is cost consuming as it can increase the price of product and that can lead to loss to the company. Our project can save both time and resources of the company so that company can enjoy profit and consumer can enjoy their product with high quality

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