MATERIAL DETECTION SYSTEM

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" I hereby declare that this report is the result of my own work except for quotes as cited in the references."

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"I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of bachelor of Electronic Engineering (Industrial Electronic Engineering) with Honours"

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Date : 12 May 2008

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ABSTRACT

This project is a modified version of the current system in the production line in a company. This system is programmed to perform and provide an appropriate usage for industrial site. This system displays the current detection of process. The Material detection could be seen in the display board and this target is set after the detection is done for each material. This system detects three kind of material which are metal, plastic and glass. Each material output have display light. With the help of this system, at production line operators need only to check the readings of individual result at display board and the compare with the production flow. This system can detect materials which has same height.

ABSTRAK

Project ini bertujuan membina sebuah system mesin penggesaan barangan industri. Contoh barang – barang seperti besi, plastik dan barangan cermin. Pada masa kini sistem yang dipraktikkan dikilang adalah terhad. Mesin ini telah pun berada dalam perindustrian Negara kita tetapi mesin ini dibuat dengan kos yang amat rendah dengan fungsi yang hampir sama dengan mesin yang berada dalam pasaran. Mesin ini boleh digunakan untuk menggesan beberapa barang pada masa yang amat singkat. Contohnya di dalam industri pembuatan barangan banyak barang yang sama dihantar untuk proses, jadi ia boleh mengesan barang lain daripada yang sepatutnya process dalam mesin tersebut yang silap hantar atau tarjatuh dalam proses.

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FIGURE LIST

TABLE LIST

LIST OF ABBREVIATION

SHORT FORM	DESCRIPTION
PCB	Printed circuit board
LED	Light emitting diode
PLC	Programmable logic control
I / O	Input / output
DC	Direct current
AC	Alternative current
VDC	Volts direct current
RST	Reset
GND	Ground
COM	Common

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CHAPTER I

INTRODUCTION

1.1 Background

The project focus as on providing material detection equipment - such as metal and non metal materials to users who wanted to detect steel, plastic and glass from product flow. These sensor devices, as well as others developed over the years, have proven effective at eliminating contamination to materials. This proposed project deals with detecting material using capacitance and inductive sensor. In this application, the PLC is used to control process. It can detect different kind of material and show the output. Detection Instruments segment develops, manufactures, and markets high-speed detection and measurement systems used for quality assurance. The sensor can detect various kinds of material (which we selected) and the result shown as pilot lamp display. PLC used in this project to sense the material. With help of this system the material can be denitrified quickly. Capacitive sensor is a proximity sensor that detects nearby objects by their effect on the electrical field on the sensor. Due to its non-directional nature, the capacitive sensor measures some capacitance from objects in the environment that are always present and therefore noisy. Inductive sensors are typically used to detect the distance between the sensor face and target. Circuit designs are optimized to utilize the electromagnetic field that extends out in front of the sensor.

Metal detection technology has reached maturity for product quality assurance. Modern metal detectors operate reliably for long periods of time, frequently in adverse environments, with little attention or maintenance. They can be configured for minimal interference with established process flow. Historically, metal and non metal detection has been employed at the output of a process, primarily to reduce liability for contaminated product. Such a location will prevent the release of contaminated product and aid in identification of failing process equipment. Metal and non metal detection at the input point of a process is also appropriate, sometimes vital, if the feedstock could be contaminated. Even if the contamination would not necessarily damage process equipment, product that would eventually be rejected by detectors at the output side could result in much processing cost wasted as a result of undetected contaminated feed. A single metal object in the feedstock, one that could be detected at the feed point and rejected at negligible cost, might be spread by processing so that an entire batch of product is ruined. This principle applies equally to intermediate steps in the processing of a product-if the output of an expensive process step is susceptible to rejection for metal contamination, both the input and the output of that step should be monitored by metal and non metal detectors. Material detectors can also be used is to verify that desired metal objects ARE present in recycling products-such as differentiate the material. Here again, it is important to monitor the product both before and after the process step in which the metal and non metal item is to be inserted, to be certain that the detected material at the output point is the desired object and does not include contamination carried from the input.

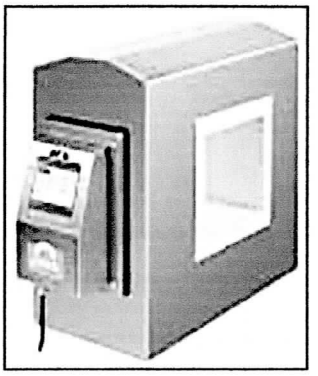

Figure 1: Industrial material detector

Figure 1 shows one of material detector that in market. However, this product this cannot differentiate the kind of material that passes through the process. My product can differentiate the kind of material pass in conveyer. As a solution using this production material detection system, we can overcome all the mistakes and can take the actual record of data throughout the production process. With the help of this system material/production flow in can be obtained.

1.2 OBJECTIVE

Over the last decade, the implementation of this concept has been attempted by using various electronics circuits. Considering all the facts this system is design to full fill certain objectives. The main objective of this project is

a) To detect different kind of material
b) To provide accurate information on the process flow.
c) To act as a display unit for the current production
d) To use PLC on this project

1.3 SCOPE OF WORK

This system is programmed to perform and provide an appropriate usage for industrial site. This system has display the current detection of process. Material detection could be seen in the display board and this target is set after the detection is done for each material. Then the relay for the detected material will be ON and the indication light also will start to flash. The sensor will be fixed on the automatic jig where the pulse can be generated into the input of this system and this can be seen in the display board. The electro-magnetic field produced by the sensor extends radically from the OD of the sensor the same distance as it extends axially from the face of the sensor. The published measurement range for a given sensor in a normal displacement application is based on the output being linear to a given specification. The sensor will be concentric with the tapped hole when detecting material using inductive technology. Capacitive proximity sensors are similar to inductive proximity sensors.

Finally the output showed as LED display. From here the person who is in charge can monitor the type of material being passed.

1.4 PROBLEM STATEMENT

There is already exist material detection machine which used in industrial section. The problem in using this resource is the difficulty in finding what kind of material passes through the process flow. In some of the industrial they handle process on mixed product (recycling industry), so there will more line operator to take care the process to make sure the process going on correct way. Mainly this will bring to production delay if the product verified manually. Secondly this will cause more man power to solve this problem. This system was design to solve these problems.

1.5 METHODOLOGY OVERVIEW

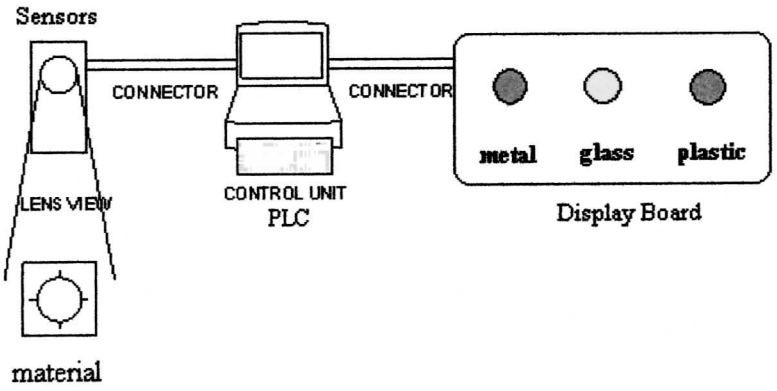

Figure 1.1: Basic Block Diagram of system

As shown in the FIGURE 1, a device for detecting metal and nonmetal objects in a conveyer having a substantial quantity of non-metals is provided. The device has a frame 1 mounted which contains the inductance detector and has wall mounting capacitive sensor for mounting in a vertical position with respect to the ground. All that is required is that the detector means is capable of identifying the material as it passes through the plane defined by distances L and R. when the material bring towards to the sensors and

the tests have been run which demonstrated the effective operation of the sensors. Send the signal to the display board.

The process flow for this system is where first when conveyer start and bring the material and at fixed place the material will stop by photoelectric sensor. Were the sensor acts as position sensor. Once material came to sensor position, signal from the sensor will detect the material and the way the conveyer will stop. After this, capacitance sensor, inductive sensor and light switch will precede their function to detect the material. With this system at production section, the people in charge just have to stand at each terminal to check and also take readings from each individual result at display board and the compare with the production output. With all this system this material detection system could act as a complete device to detect the material at production line. Industrial site and food service operations are some of many facilities which require a simple, easy to operate yet effective for detecting the presence of metal and non metal.

CHAPTER II

LITERATURE REVIEW

2.1 LITERATURE STUDY

Material detection system has been introduced in the industrial ages ago and most of the companies are using it to improve their production output and at the same time to take data on production outcome. Material detection machine has been introduced in the industrial ages ago and most of the companies are using it to improve their production output. From my research and study on this material detection machine I have overcome a number of existing methods which is still in use. After doing my literature study on these devices which is related to my project I then decided to pick two examples as my project background.

In, [1] How Metal Detectors Work (Mark Rowan & William Lahr). Some products in market using different kind of method for detect material for example, some use transmitter and receiver as detector. Inside the metal detector's loop (sometimes called a search head, coil, antenna, etc.) is a coil of wire called the transmit coil. Electronic current is driven through the coil to create an electromagnetic field. The direction of the current flow is reversed several thousand times every second; the transmit frequency "operating frequency" refers to the number of times per second that the current flow goes from clockwise to counterclockwise and back to clockwise again. When the

current flows in a given direction, a magnetic field is produced whose polarity (like the north and south poles of a magnet) points into the ground; when the current flow is reversed, the field's polarity points out of the ground. Any metallic (or other electrically conductive) object which happens to be nearby will have a flow of current induced inside of it by the influence of the changing magnetic field, in much the same way that an electric generator produces electricity by moving a coil of wire inside a fixed magnetic field. This current flow inside a metal object in turn produces its own magnetic field, with a polarity that tends to be pointed opposite to the transmit field. Receiver is a second coil of wire inside the loop, the receive coil, is arranged (by a variety of methods) so that nearly all of the current that would ordinarily flow in it due to the influence of the transmitted field is cancelled out. Therefore, the field produced by the currents flowing in the nearby metal object will cause currents to flow in the receive coil which may be amplified and processed by the metal detector's electronics without being swamped by currents resulting from the much stronger transmitted field. This method is proximately effective for metal detection.

2.2 Metal detector in food industry

Most metal detectors use a balanced, three-coil, system to detect small particles of non-ferrous and stainless steel. The coils are wound on a non-metallic frame, each parallel with the other. The center coil is connected to a high frequency radio transmitter. Coils on either side of the transmitter coil are receivers. As these two coils are identical and placed the same distance from the transmitter, they receive the same signal and produce an identical output voltage. When the coils are connected in opposition, the output is cancelled, resulting in a zero value. A schematic of the coil configuration is shown in figure 1. When a particle of metal passes through the coils of a metal detector, the high frequency field is disturbed under one coil, changing the voltage by a few micro volts. The state of balance is lost and the output from the coils is no longer zero. It is this phenomenon that is used to detect metal an important aspect of metal detector operation is the metal free zone, which is needed for proper operation. The zone includes a space on each side of the aperture that must be free from any metal structure such as rollers and supports. As a

general rule, this needs to be approximately 1.5 times the aperture height for fixed structures and 2 times the aperture height for moving metal such as reject devices or rollers.

2.2.1 What can be detected by this machine

All metals are ferrous, nonferrous or stainless steel. The ease of detection will depend on their magnetic permeability and electrical conductivity. Table 1 shows metal types and their ease of detection. The size, shape and orientation (with respect to the detector coils) of the metal particle also is important. Since size, shape and orientation of metal contaminants is not possible to control, it is best to operate a metal detector at the highest possible sensitivity setting

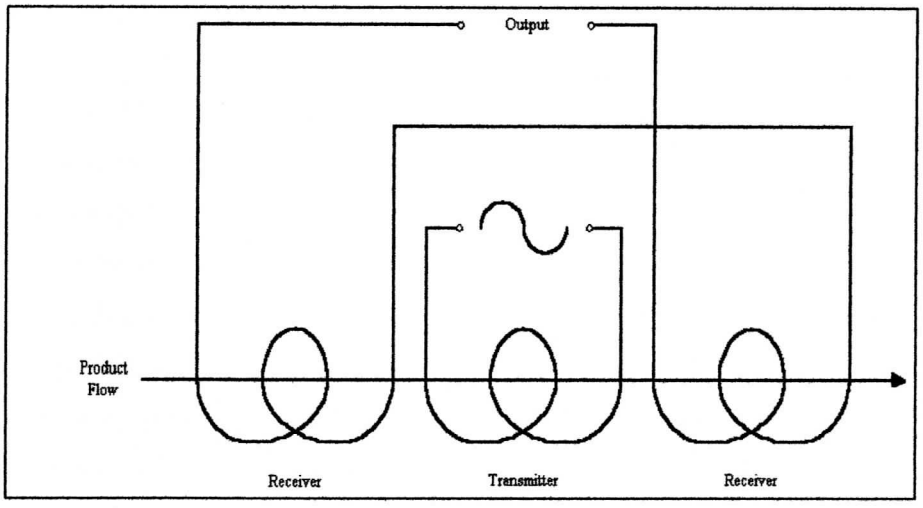

Figure 2.0: Detector Coil

2.3 ABM metal detector

For many years ABM Metal Detectors has designed various types and sizes of metal detecting systems for applications ranging from the food manufacturing up to systems that require special DIP requirements used in the defense industries or other hazardous areas. Our metal detector aperture sizes can range from a small 100mm wide x 70mm high, up to a massive 2400mm wide x 1200mm high for the special application with excellent sensitivity and product compensation control.

All models are high performance metal detectors suitable for detecting ferrous and non-ferrous metallic contamination in a wide range of non-metallic products. These units consist of a detector head, an electronic module with power supply and relay output with full reject timing controls. A selected range of Series 4B detectors can as an option be constructed with removable end plate design or remote mounted electronic controls up to 10 meters away without any operating problems.

Also available is a range of vertical fall or drop through metal detectors which can also be used for pipeline applications. The VF range of detectors have an extremely low metal free zone of approximately 40mm each side of the detector head and also as a standard, have remote mounted controls up to 10 meters away for ease of operation. These drop through metal detectors are commonly used on form fill and seal machines mounted just above the forming tube or other applications for gravity fed, free flowing powders, pipeline, liquid or granular materials. Each model in the range operates with analog main controls with digital pulse phase modulation and phase discriminating signal demodulation network coupled to a dual gated detection system. The dual gated detection system is a feature that eliminates early tripping when metal contaminants are being conveyed through the detector head. Detection actually occurs when the metal contaminants just pass through the centre of the detector head. This system allows excellent product compensation and sensitivity, also minimizes the amount of good product reject.