



Identification and sorting of faulty printed circuit board using image processing

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Abstract-The objective of the project is to collect the desired items with help of image processing and dispose the unwanted items using rejection mechanism. The PCB's are moved from one place to another with the help of Geneva conveyor. It is necessary to minimize the workers involved in it. We have designed a conveyor with Geneva drive which is useful in industries. So, here we have made a conveyor model which is used for transformation from one place to another. Our model consists of a Geneva conveyor model, collecting tray and dc gun.

I. INTRODUCTION

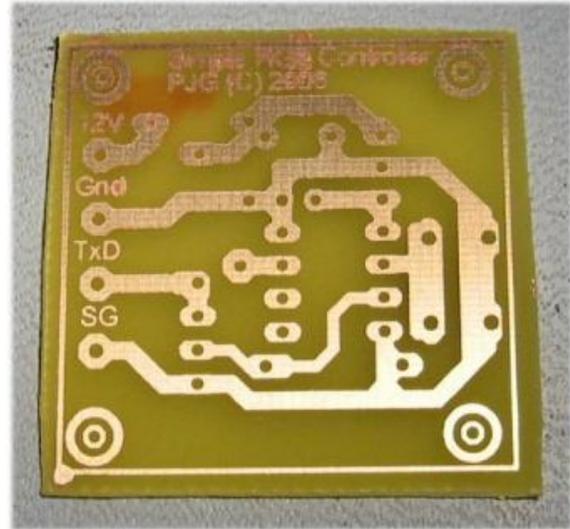
Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or, a set of characteristics or parameters related to the image. When we press the start key, the conveyor gets started.

Two rollers are mounted according to the required distance the belt is mounted on the rollers on which the PCBs are placed. The rollers shaft is coupled with the drive. The drives' shaft is coupled with the motor shaft hence when power is supplied, motor rollers rotate with a certain time delay according to the Geneva drive and the belt moves along the rollers. Thus PCB handling is carried out.

With help of the Geneva drive the time delay can be achieved. The proximity sensor is used to count the rotation of the conveyor and it will stop after particular rotation. Once it is detected the conveyor stops. The image is stored in the computer and the selected correct PCB is collected in a separate tray and the damaged PCB track is collected in another tray with the help of dc gun. A pushing plate is mounted in front of the dc gun with help of hinge and spring arrangement. When the dc gun extends it

pushes the plate hence the PCB in front is also pushed and collected in the tray. When the Dc gun is

retracted the plate also comes back to its position with help of spring.



II. MICRO CONTROLLER

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- a. The CPU core
- b. Memory(both ROM and RAM)
- c. Some parallel digital i/o

Microcontrollers will combine other devices such as:

- A timer module to allow the microcontroller to perform tasks for certain time periods.
- A serial i/o port to allow data to flow between the controller and other devices such as a PIC or another microcontroller.
- An ADC to allow the microcontroller to accept analogue input data for processing.

Microcontrollers are:

- Smaller in size
- Consumes less power
- Inexpensive

Micro controller is a standalone unit, which can perform functions on its own without any requirement for additional hardware like i/o ports and external memory.

The heart of the microcontroller is the CPU core. In the past, this has traditionally been based on a 8-bit microprocessor unit. For example Motorola uses a basic 6800 microprocessor core in their 6805/6808 microcontroller devices.

In the recent years, microcontrollers have been developed around specifically designed CPU cores, for example the microchip PIC range of microcontrollers.

III. D.C MOTOR

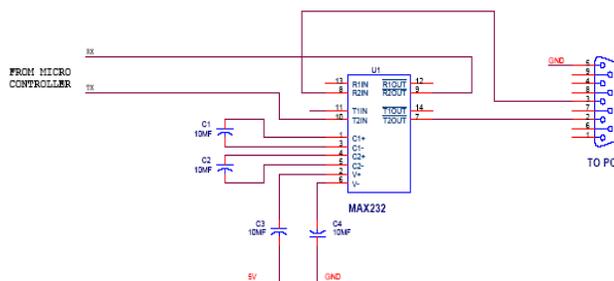
The d.c generators and d.c motors have the same general construction.

MOTOR PRINCIPLE:

An electric motor is a machine which converts a electrical energy to mechanical energy.

All D.C machines have five principal components viz (i) Field system (II) armature core (iii) armature winding (iv) Commutator (v) brushes..

IV. RS232 COMMUNICATION



RS232:

In telecommunications, RS-232 is a standard for serial binary data interconnection between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment). It is commonly used in computer serial ports.

Scope of the Standard:

The Electronic Industries Alliance (EIA) standard RS-232-C [3] as of 1969 defines:

- Electrical signal characteristics such as voltage levels, signaling rate, timing and slew-rate of signals, voltage withstand level, short-circuit behavior, maximum stray capacitance and cable length
- Interface mechanical characteristics, pluggable connectors and pin identification
- Functions of each circuit in the interface connector
- Standard subsets of interface circuits for selected telecom applications

The standard does not define such elements as character encoding (for example, ASCII, Baudot or EBCDIC), or the framing of characters in the data stream (bits per character, start/stop bits, parity). The standard does not define protocols for error detection or algorithms for data compression.

The standard does not define bit rates for transmission, although the standard says it is intended for bit rates lower than 20,000 bits per second. Many modern devices can exceed this speed (38,400 and 57,600 bit/s being common, and 115,200 and 230,400 bit/s making occasional appearances) while still using RS-232 compatible signal levels.

Details of character format and transmission bit rate are controlled by the serial port hardware, often a single integrated circuit called a UART that converts data from parallel to serial form. A typical serial port includes specialized driver and receiver integrated circuits to convert between internal logic levels and RS-232 compatible signal levels.

V. LCD DISPLAY

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed. Polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.

On each polariser is pasted outside the two glass panels. These polarisers would rotate the light rays passing through them to a definite angle, in a particular direction.

When the LCD is in the off state, light rays are rotated by the two polarisers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent.

When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarisers, which would result in activating / highlighting the desired characters.

The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations.

The LCD's don't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range.

Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly.

The LCDs used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

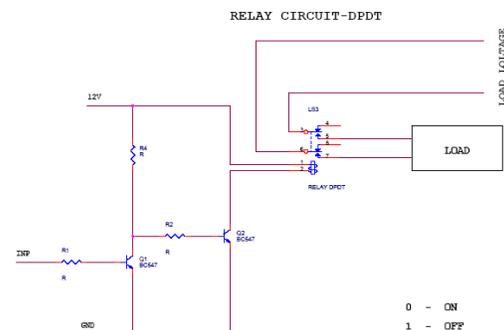
VI. POWER SUPPLY UNIT

Power supply is an integral part a vital role in every electronic system and hence their design constitutes a major part in every application. In order to overcome mal-operation which results due to fluctuations in the load and discontinuity in the supply proper choice of power supply is indeed a great need in this hour.

The present chapter introduces the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies, or the output load connected to the dc voltage changes.

A block diagram containing the parts of a typical power supply and the voltage at various points in the unit is shown in fig 19.1. The ac voltage, typically 120 V rms, is connected to a transformer, which steps that ac voltage down to the level for the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit can use this dc input to provide a dc voltage that not only has much less ripple voltage but also remains the same dc value even if the input dc voltage varies somewhat, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of a number of popular voltage regulator IC units.

VII. RELAY CIRCUIT-DPDT



RELAY

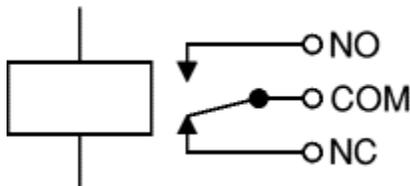
A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the

switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.



Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.



The relay's switch connections are usually labeled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.

- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normally Open, COM is connected to this when the relay coil is **on**.

DPDT:

A DPDT (double-pole double-throw) relay has two pairs of contacts or "throws" and two magnetically activated switch contacts or "poles". A current applied to the relay coil causes both poles to switch.

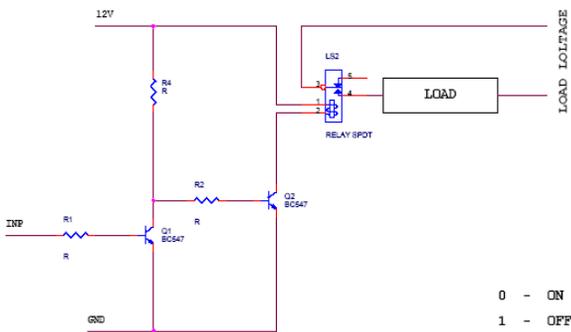
Circuit description:

This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The DPDT relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of six pins. They are two set of Common, Normally close (NC) and Normally open (NO) pins.

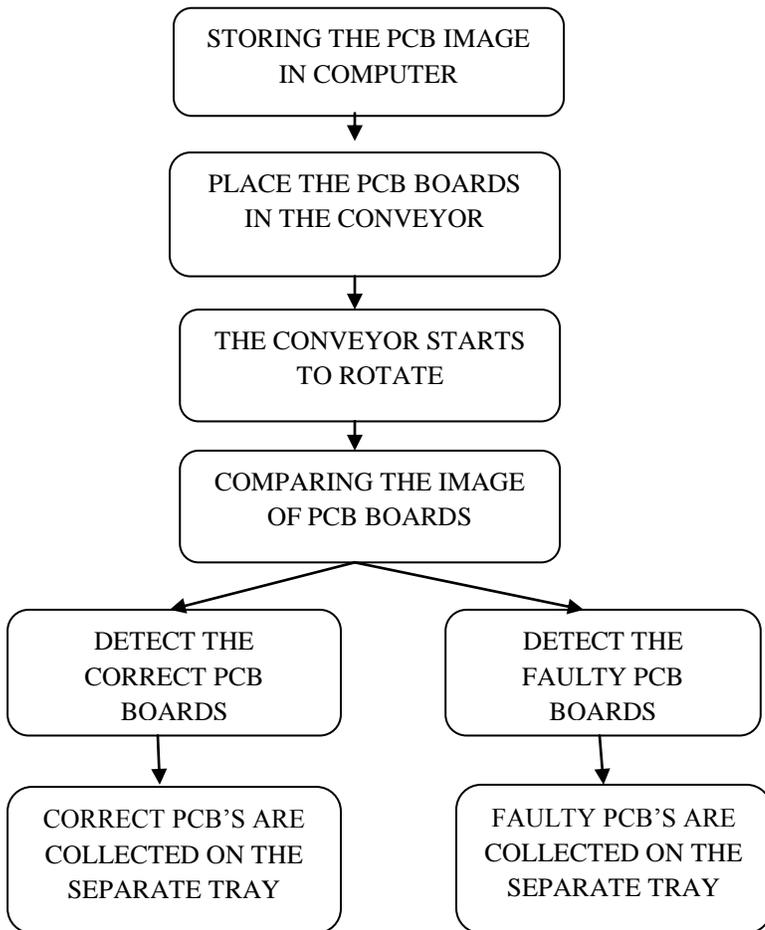
The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals Is given to base of the Q2 transistor. So the relay is turned OFF state.

When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of T2 transistor so the transistor is conducting and relay is energized. Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

RELAY CIRCUIT - SPST



VIII. FLOW DIAGRAM



IX. CONCLUSION

A Computer Vision system for printed circuit board (PCB) automated inspection was developed to detect bare-board manufacturing errors, like missing tracks, circuit shorts, missing holes, opens, breaks, etc. The system uses standard PCB images; their characteristics are saved in a database.

The adopted referential approach compares PCB images to the standard images. Some difficulties were observed. One difficulty is with the pre-processing technique. It is important that the environment lighting should be uniform and that all inspected PCB belong to the same category.

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