Material Dimension Analyzing in Conveyor

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Abstract - *In this project "MATERIAL DIMENSION ANALYSING IN CONVEYOR" being with* an introduction to material Inspection, its various applications. The sensors are used to measure the material dimensions and this signal is given to the Control Unit. The control unit gives the appropriate signal to the pneumatic cylinder. The pneumatic cylinder is used to collecting mechanism of the improper dimension materials. The inspection conveyor is very useful for material handling in modern engineering industries. The motor is used to drive the conveyor. The materials are transferred from one place to another place by using a conveyor. In this top of the conveyor, sensors are used to measure the dimension. This system gives smooth operation and smooth movement of the belts to the jobs at the required time. This is a very efficient instrument for checking the dimensions like length, breadth, height etc. to be used in modern engineering industries. The manual efforts can be completely avoided by using this modern equipment. It also reduces inspection time and manual inspection errors. If the work piece is defective, the pneumatic cylinder placed next to the sensor will be actuated to remove the defective work piece.

Key words: Conveyor, D.C Motor, Screw Rod, Metal Sensor, Microcontroller, LCD Display

1. INTRODUCTION

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Degrees of automation are of two types, viz.

- Full automation.
- Semi automation.

In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

Need For Automation - Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production.

For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa.

Quality Control and Inspection are the most important things in factory design. Automation plays a vital role in mass production of a product, the machining operations decides the sequence of machining. The machines designed for producing a particular product are called transfer machines. Conveyor Automation is a specialized activity for a modern manufacturing concern. It has been estimated that about 60-70% of the cost production is spent in material transferring activities

Need for Dimension analysis - Reduction of lab our and material cost, Reduction of overall cost, Increased production, Increased storage capacity, Increased safety, To reduce the inspection time, Reduction in fatigue, Improved personnel comfort

2. METHODOLOGY

The Material Dimension analysis machine comprised of conveyor to carry the material and dimension analysis system will detect and analyses the dimension of the material such as length and width. Dimension will be measured in "**mm"** and displayed onto LCD display device. Dimension analysis System consists of Sensor, Microcontroller to detect and measure the dimension and LCD display to display the measurements.

The proposed system will consists of following function units: Conveyor, D.C Motor, Screw Rod, Metal Sensor, Microcontroller, LCD Display.

[1] Working Principle

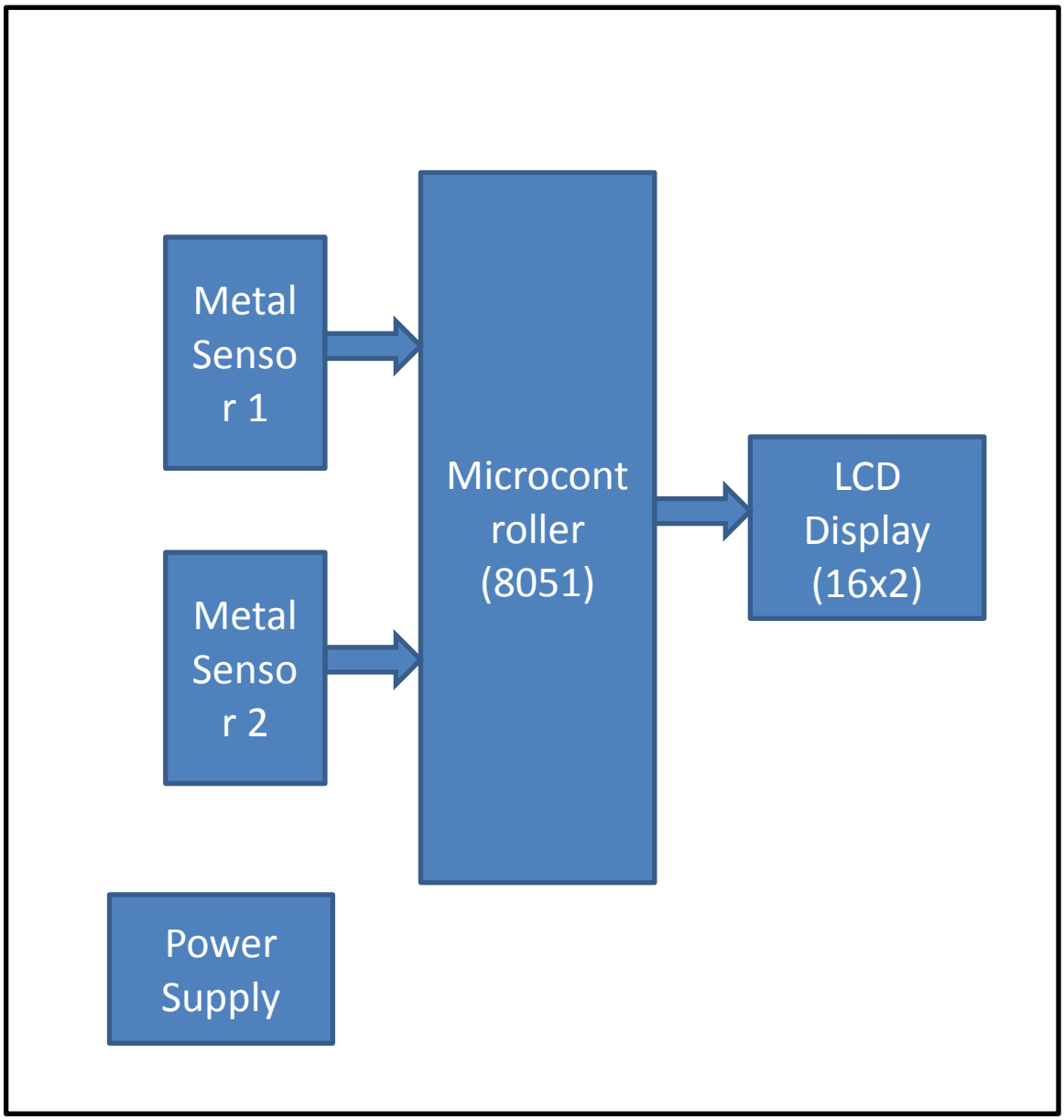


Fig 1.1: Block diagram of dimension analysis system

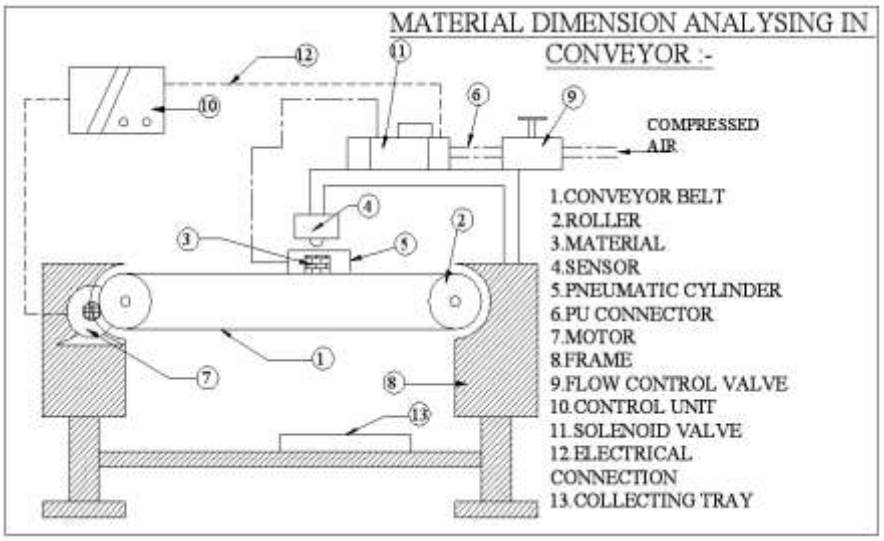


Fig 1.2: Reference design of material dimension analysis machine

A) Conveyor

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available, and are used according to the various needs of different industries. In this project we are using conveyor to carry the material (job) whose dimension is to be measured.

Fig 1.3 Conveyor

B) D.C Motor

A DC motor is an electric motor that runs on direct current (DC) electricity. DC motors were used to run machinery, often eliminating the need for a local steam engine or internal combustion engine. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines. In this project D.C Motor is used to provide the rotational movement to the conveyor belt and screw rod. We have chosen a D.C motor with a speed of 100 rpm for screw rod and D.C motor with a speed of 10 rpm for conveyor belt.

C) Screw Rod

Screw rod or a threaded rod, also known as a stud, is a relatively long rod that is threaded on both ends; the thread may extend along the complete length of the rod. They are designed to be used in tension. Threaded rod in bar stock form is often called all-thread. In this project the screw rod fitted with D.C motor is used to measure the breadth of the material.

D) Metal Sensor

Metal sensor or a metal detector is a device which responds to metal that may not be readily apparent. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer) the change in the magnetic field due to the metallic object can be detected. In this project we are using metal housing capacitive sensor to detect the material. Conveyor and screw rod motion is used to detect the presence of the metal on the conveyor.

E) Microcontroller

Microcontroller (sometimes abbreviated µC, uC or MCU) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications.

Microcontroller is the heart of material dimension analysis system. It will read the input from the sensors, analyses the data and display onto display device. Microcontroller has been programmed (embedded software) to control the system.

F) LCD Display

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly.

LCD displays are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, 7-segment displays, etc., as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

In this project LCD is used to display the material dimension in mm unit. Such as “length =:” “width=:” and welcome text such as “Material Dimension Analysis “to indicate the start of the system.

ELECTRONIC HARDWARE DESCRITION

AT89S52 MICROCONTROLLER:

Features:

- Compatible with MCS®-51 Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory –Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time
- Flexible ISP Programming (Byte and Page Mode)
- Green (Pb /Halide-free) Packaging Option

3. Block Diagram

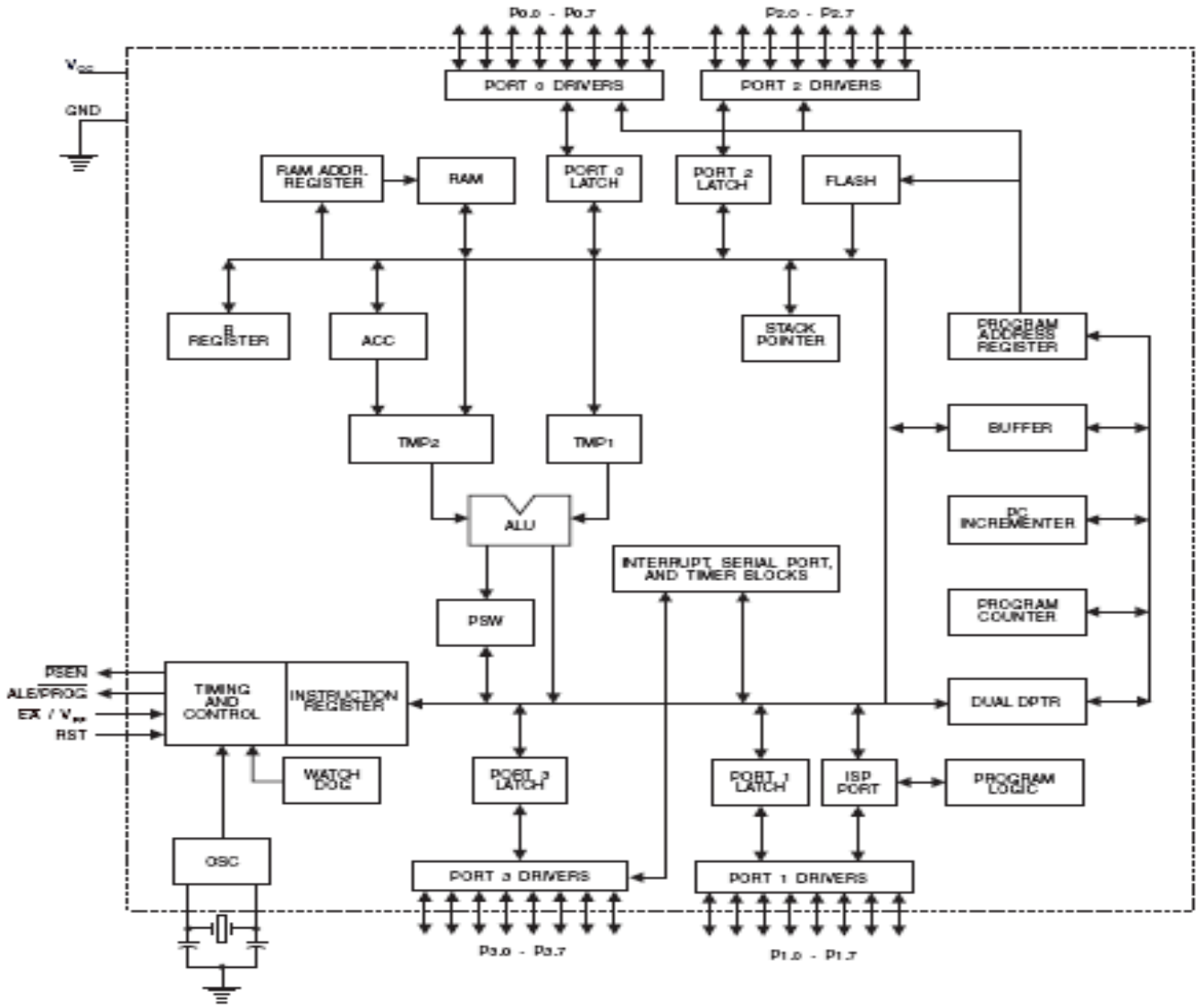


Fig 1.4 AT8s52 Architecture Diagram

Description

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the Indus-try-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory pro-grammar. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

Port 0

Port 0 is an 8-bit open drain bidirectional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high-impedance inputs. Port 0 can also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory.

In this mode, P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1

Port 1 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins, they are pulled high by the inter-nal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively, as shown in the following table. Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2

Port 2 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 16-bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 also receives the high-order address bits and some control signals during Flash programming and verification. Port Pin

Alternate Functions P1.0 T2 (external count input to Timer/Counter 2), clock-out P1.1 T2EX (Timer/Counter 2 capture/reload trigger and direction control) P1.5 MOSI (used for In-System Programming) P1.6 MISO (used for In-System Programming) P1.7 SCK (used for In-System Programming).

Port 3

Port 3 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 receives some control signals for Flash programming and verification. Port 3 also serves the functions of various special features of the AT89S52, as shown in the following table.

RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. This pin drives high for 98 oscillator periods after the Watchdog times out. The DISRTO bit in SFR AUXR (address 8EH) can be used to disable this feature. In the default state of bit DISRTO, the RESET HIGH out feature is enabled.

ALE/PROG

Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external data memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

PSEN

Program Store Enable (PSEN) is the read strobe to external program memory. When the AT89S52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/VPP

External Access Enable, EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming.

XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2

Output from the inverting oscillator amplifier.

Memory Organization

MCS-51 devices have a separate address space for Program and Data Memory. Up to 64K bytes each of external Program and Data Memory can be addressed.

Program Memory

If the EA pin is connected to GND, all program fetches are directed to external memory. On the AT89S52, if EA is connected to VCC, program fetches to addresses 0000H through 1FFFH are directed to internal memory and fetches to addresses 2000H through FFFFH are to external memory.

Data Memory

The AT89S52 implements 256 bytes of on-chip RAM. The upper 128 bytes occupy a parallel address space to the Special Function Registers. This means that the upper 128 bytes have the same addresses as the SFR space but are physically separate from SFR space. When an instruction accesses an internal location above address 7FH, the address mode used in the instruction specifies whether the CPU accesses the upper 128 bytes of RAM or the SFR space. Instructions which use direct addressing access the SFR space. For example, the following direct addressing instruction accesses the SFR at location 0A0H (which is P2). MOV 0A0H, #data Instructions that use indirect addressing access the upper 128 bytes of RAM. For example, the following indirect addressing instruction, where R0 contains 0A0H, accesses the data byte at address 0A0H, rather than P2 (whose address is 0A0H). MOV @R0, #data Note that stack operations are examples of indirect addressing, so the upper 128 bytes of data RAM are available as stack space.

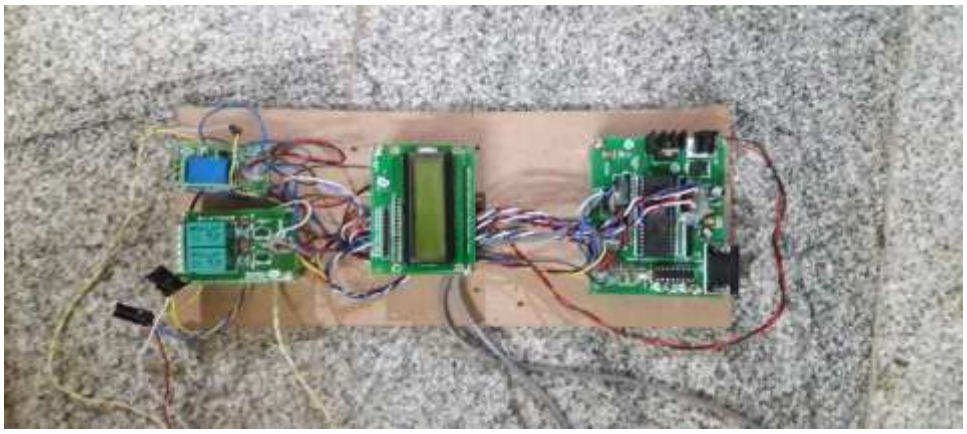


Fig 1.5 Electronic Hardware

ALPHA NUMERIC LCD DISPLAY

A liquid crystal display (LCD) is a flat panel display, electronic visual display, based on Liquid Crystal Technology.

A liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. Liquid crystals do not emit light directly instead they use light modulating techniques.

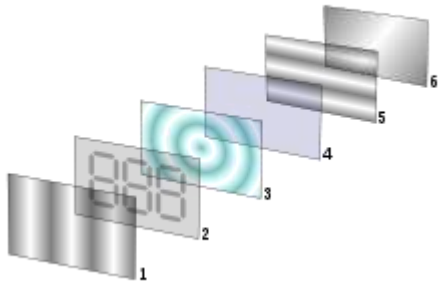
LCDs are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones.

LCDs are preferred to cathode ray tube (CRT) displays in most applications because:

- The size of LCDs comes in wider varieties.
- They do not use Phosphor; hence images are not burnt-in.

- Safer disposal
- Energy Efficient
- Low Power Consumption.

It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome.



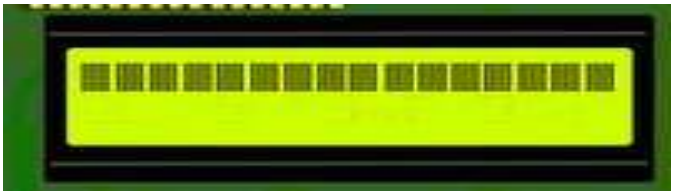


Fig 1.6 Reflective liquid crystal display

1. Polarizing filter film with a vertical axis to polarize light as it enters.
2. Glass substrate with ITO electrodes. The shapes of these electrodes will determine the shapes that will appear when the LCD is turned ON. Vertical ridges etched on the surface are smooth.
3. Twisted pneumatic liquid crystal.
4. Glass substrate with common electrode film (ITO) with horizontal ridges to line up with the horizontal filter.
5. Polarizing filter film with a horizontal axis to block/pass light.
6. Reflective surface to send light back to viewer. (In a backlit LCD, this layer is replaced with a light source.

METAL SENSOR

Metal sensor or a metal detector is a device which responds to metal that may not be readily apparent. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer) the change in the magnetic field due to the metallic object can be detected. In this project we are using metal housing capacitive sensor to detect the material. Conveyor and screw rod motion is used to detect the presence of the metal on the conveyor.

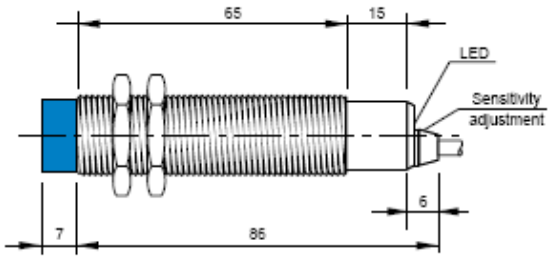
Features:

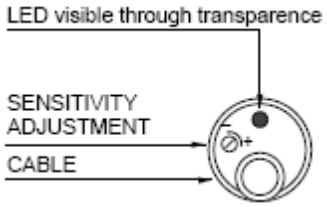
- Four wires, 12-30 VDC
- NPN - NO and NC
- PNP - NO and NC
- Adjustable range, 9-turn trimmer
- Nickel-plated brass
- High noise immunity
- High temperature stability.

Fig 1.7 Used Sensor

Sensitivity adjustment

The sensitivity adjustment must be done when the sensor is installed in a definite and steady position. The regulation must be done in a position half way between minimum and maximum, because, being air dielectric, a strong humidity variation could cause, if the regulation is very light, nuisance tripping. The sensing distance of the sensor depends on the kind of material to detect and on its dimensions (see table about reduction factors). The distance could change according to temperature variations. To increase the sensitivity twist the trimmer clock-wise, to decrease do it anti clock-wise.

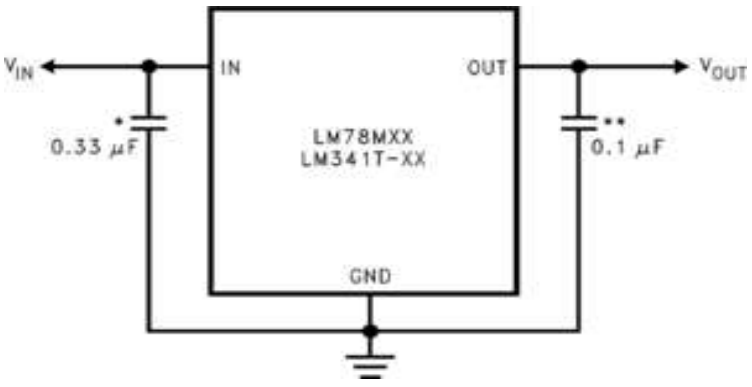


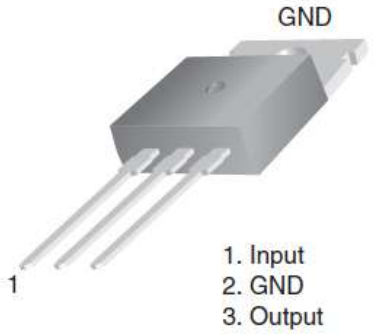


POWER SUPPLY

LM7805 Positive Voltage Regulator

The LM78XX series of three terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.





Features

- Output current in excess of 0.5A
- No external components
- Internal thermal overload protection
- Internal short circuit current-limiting
- Output transistor safe-area compensation
- Available in TO-220, TO-39, and TO-252 D-PAK packages
- Output voltages of 5V, 12V, and 15V

Power supply circuit

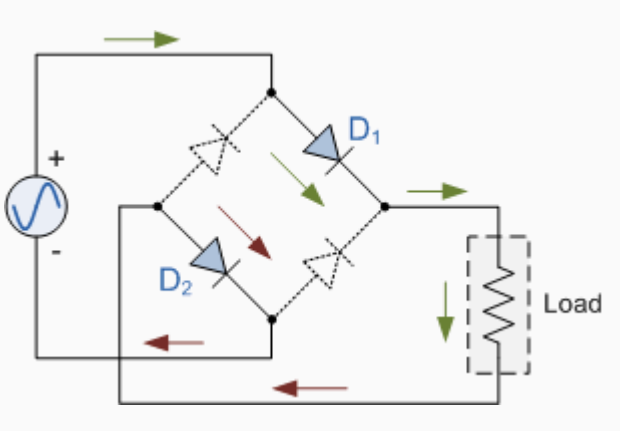
From a 12V Adaptor, input is taken into the power supply unit via a DC Socket.

A 5V regulator circuit is designed using LM7805 as shown below which is needed for microcontroller as supply voltage.

A 12V Bridge rectifier in between the DC Socket and LM7805 is used.

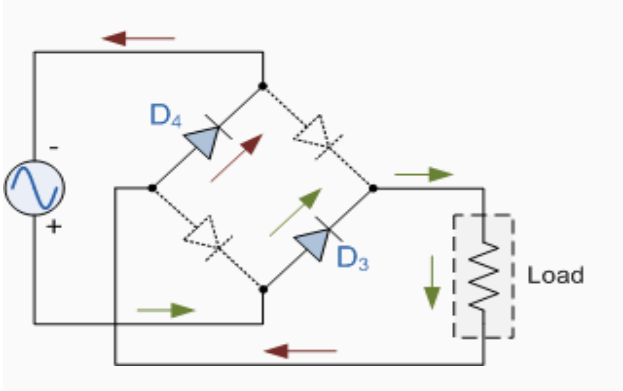
This Bridge continues to provide supply even in case of Power- pin polarity inversion at the DC Socket.

The Positive Half-cycle



During the Positive half cycle of the supply, diodes D1 and D2 conduct in series, but diodes D3 and D4 switch "OFF" as they are now reverse biased. The current flowing through the load is the same direction.

The Negative Half-cycle



During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch "OFF" as they are now reverse biased. The current flowing through the load is the same direction as before.

As the current flowing through the load is unidirectional, so the voltage developed across the load is also unidirectional the same as for the previous two diode full-wave rectifier, therefore the average DC voltage across the load is 0.637Vmax. However in reality, during each half cycle the current flows through two diodes instead of just one so the amplitude of the output voltage is two voltage drops (2 x 0.7 = 1.4V) less than the input VMAX amplitude.

The ripple frequency is now twice the supply frequency (e.g. 100Hz for a 50Hz supply)

CONCLUSION

Quality Control and Inspection are the most important things in factory design. Automation plays a vital role in mass production of a product, the machining operations decides the sequence of machining. The machines designed for producing a particular product are called transfer machines. Conveyor Automation is a specialized activity for a modern manufacturing concern. It has been estimated that about 60-70% of the cost production is spent in material transferring activities.

We would like to hereby conclude that our project work to design and development of microcontroller and sensor based automatic dimension analysis and measurement system will be of greater use in the following areas of application:

APPLICATIONS

Discharge of work piece

The Conveyor Feed has a wide application in low cost automation industries. It can be used in automated assembly lines to carry up the finished product from workstation and place them in bins. It can also be used to pick raw material and place them on the conveyor belts.

Improper Material Removing operation

This unit can also be used in improper material collected in a collecting box. The solenoid operated pneumatic cylinder is used for this mechanism.

ADVANTAGES

- The Inspection Conveyor is more efficient in the technical field
- Quick response is achieved
- Simple in construction
- Easy to maintain and repair
- Cost of the unit is less when compared to other
- No fire hazard problem due to over loading
- Comparatively the operation cost is less
- Continuous operation is possible without stopping

LEARNING OUTCOME OF PROJECT WORK

- Understanding the hardware detail of a 8051 Microcontroller
- Experience on Microcontroller programming in Keil C
- Exposure to Embedded System Technology
- Working and Development experience on Microcontroller based Material Dimension analysis System.

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