ST.ANNE'S

COLLEGE OF ENGINEERING AND TECHNOLOGY
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ME8781 MECHATRONICS LAB MANUAL

INDEX

STUDY OF TRANSDUCERS AND SENSORS

Transducers:

Devices used to transform one kind of energy to another. When a transducer converts a measurable quantity (sound pressure level, optical intensity, magnetic field, etc) to an electrical voltage or an electrical current we call it a sensor. We will see a few examples of sensors shortly. When the transducer converts an electrical signal into another form of energy, such as sound (which, incidentally, is a pressure field), light, mechanical movement, it is called an actuator. Actuators are important in instrumentation. They allow the use of feedback at the source of the measurement. However we will pay little attention to them in this course. The study of using actuators and feedback belongs to a course in Control theory. A sensor can be considered in its bare form, or bundled with some electronics (amplifiers, decoders, filters, and even computers). We will use the word instrument to refer to a sensor together with some of its associated electronics. The distinction between a sensor and an instrument is extremely vague, as it is increasingly common to manufacture integrated sensors. What follows is equally applicable to sensors and/or instruments. The discussion is also applicable to circuits, such as amplifiers, filters, mixers and receivers. Signal processing circuits are, in a sense, instruments. It is not very important that both input and output signals are, for example, voltages.

Characteristics of Transducer:

1. Accuracy: This is a measure of the accuracy of the transducer output representing the true value being measured. It is defined as

Ea = (Ot - Om)/Ot x 100%

where Ea is the error, Ot is the true value being measured, Om is the transducer or system output.

Accuracy is often defined in terms of a full scale output and is defined as

Es = (Ot - Om)/Os x 100%

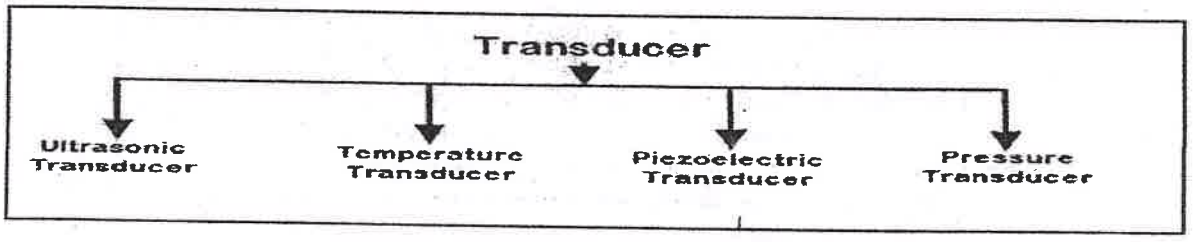
where Es is the full scale error, and Os is the full scale output.

2. Precision: This is a measure of the deviation from a mean value computed from a set of readings obtained for a single given input. In other words the repeatability of a transducer reading is defined by the precision specified for a specific transducer.
3. Resolution: This is a measure of smallest incremented unit of the input signal that can be measured by the transducer.
4. Sensitivity: The ratio of the output to the input gives a measure of a transducer systems sensitivity to a given input.
5. Drift: The change in the transducer output for a zero input or its sensitivity over a period of time, change in temperature, humidity or some other factor.
6. Linearity: The degree to which a given calibration curves fits a straight line within a range of the full scale output of the transducer. Linearity is often a desirable trait in instrumentation design. A transducer output may be non-linear over its entire range, but a portion of its curve over a limited range may be fairly linear; this range may be used in instrumentation design.
7. Conformance: For a non-linear transducer, the tightness of fit to a specified curve is known as conformance of conformity.
8. Span: The operational full scale range of the transducer is known as the span. The span is therefore defined as the difference between the maximum and minimum outputs of the transducer.
9. Hysteresis: The difference in transducer output Y for the same input X dependent on the manner in which the input signal X is varied.
10. Distortion: The difference of the actual output from the expected result as defined by a known linear or non-linear relationship (curve) of input and output for the transducer.

11. Noise: A signal generated by internal circuitry or external interference that is superimposed or added to the output signal.

The above characteristics of a transducer are generally determined by examining the output response of a transducer to various input signals. Test conditions simulate actual operating conditions as closely as possible. Standard statistical and computational methods can be applied to the test data. For further information refer to standard texts on laboratory practice and measurements.

Types of Transducers

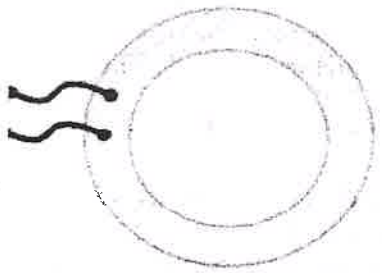


Types of Transducers

There are various types of transducers such as piezoelectric transducer, pressure transducer, temperature transducer, ultrasonic transducer, and so on. Let us see the use of these types of transducers in practical applications.

Piezoelectric Transducer

Piezoelectric transducers are a special type of sensors, using these piezoelectric transducers mechanical energy can be converted into electrical energy and similarly, electrical energy can be converted into mechanical energy.



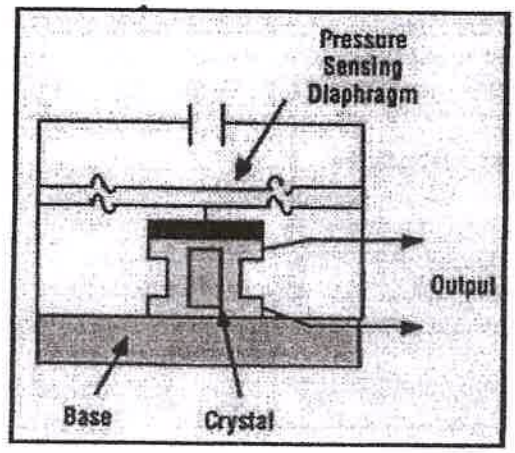
Piezoelectric Transducer

Practical Application of Piezoelectric Transducer

Piezoelectric transducers are used for detecting the drummer's sticks impact in electronic drum pads. These are also used for the detection of muscle movements which can be termed as acceleromyography. The engine load can be determined by measuring manifold absolute pressure, which can be done by using piezoelectric transducers in fuel injection systems as MAP sensors. Piezoelectric sensors can be used as knock sensors in automotive engine management systems for detecting engine knock.

Pressure Transducer

Pressure transducer can be defined as a special type of pressure sensor that converts the pressure imposed into electrical signals. Pressure transducers are also termed as pressure indicators, transmitters, manometers, piezometers, and pressure sensors.



Pressure Transducer

Practical Application of Pressure Transducer

Pressure transducers are specially used for measuring the pressure of the particular quantity such as gas or liquid by converting the pressure into electrical energy. There are different types of pressure transducers such as a mill volt pressure transducer, amplified voltage pressure transducer, 4-20mA pressure transducer, and strain-gage base pressure transducer.

The pressure transducers are used in numerous applications such as pressure sensing, altitude sensing, flow sensing, level or depth sensing, and leak testing. The pressure transducers can be used for electrical power generation by using these sensors under the speed breakers of the roads or highways where the pressure of the vehicles can be converted into electrical energy.

Temperature Transducer

Temperature transducer can be defined as a device that converts temperature of a system or device into other quantity such as electrical energy or mechanical energy or pressure, which is then sent to the control system for controlling the temperature of the system.

Temperature Transducer

Practical Application of Temperature Transducer

Temperature transducers are majorly used for measuring air temperature such that to control the temperature of many control systems such as heating, air-conditioning, ventilation, and so on. There are different types of transducers used for measuring temperature of various systems.

Let us consider a practical temperature transducer used for controlling temperature of any device based on requirement for various industrial applications. The Arduino based temperature controlled automatic fan speed regulator project is used for controlling the fan speed and displaying temperature measure on an LCD display.

Practical Application of Ultrasonic Transducer

The ultrasonic transducer can be used for measuring distance based on reflection of sound. The ultrasonic transducer based distance measurement is an appropriate method compared to the conventional methods which use various measuring scales. The areas which are inaccessible, such as very high temperature and pressure areas, the distance measurement is not an easy task using conventional methods. So, this ultrasonic transducer based measuring system can be used in these types of zones.

This project uses 8051 microcontroller, an ultrasonic transducer module that consists of transmitter and receiver, LCD display, and power supply block are used which are connected in the block diagram shown in the figure.

Viva Question

1. Define transducers.

A transducer is an electronic device that converts energy from one form to another. Common examples include microphones, loudspeakers, thermometers, position and pressure sensors, and antenna. Although not generally thought of as transducers, photocells, LEDs (light-emitting diodes), and even common light bulbs are transducers.

2. State the working principle of proximity sensors.

A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors.

3. List out the different types of temperature sensors.

Negative Temperature Coefficient (NTC) thermostat

Resistance Temperature Detector (RTD)

Thermocouple.

Semiconductor-based sensors.

4. Define strain gauge?

A device for indicating the strain of a material or structure at the point of attachment.

5. What is the use of a light sensor?

Light Sensor. A Light Sensor is something that a robot can use to detect the current ambient light level - i.e. how bright/dark it is. There are a range of different types of light sensors, including 'Photoresistors', 'Photodiodes', and 'Phototransistors'.

STUDY OF IMAGE PROCESSING TECHNIQUE

AIM:

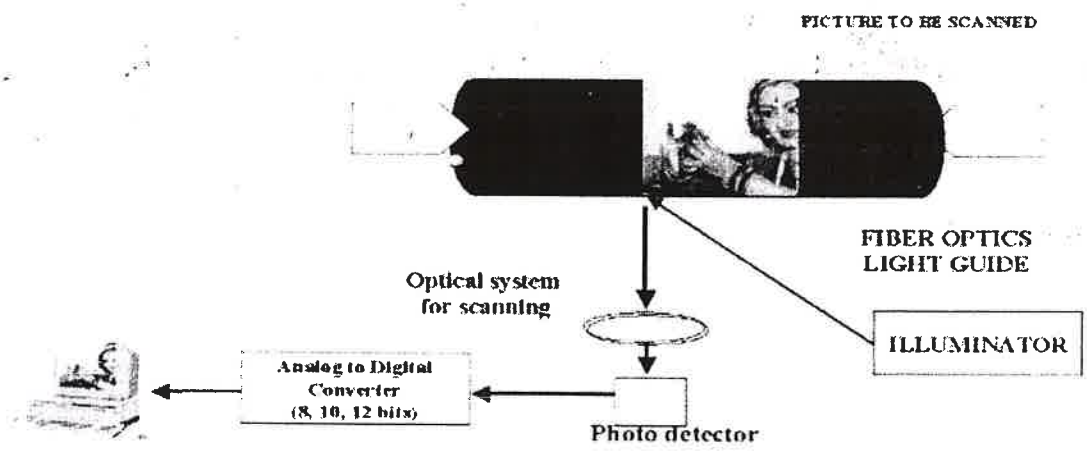
To study about image processing techniques.

Introduction

Image Processing is a technique to enhance raw images received from cameras/sensors placed on satellites, space probes and aircrafts or pictures taken in normal day-to-day life for various applications. Various techniques have been developed in Image Processing during the last four to five decades. Most of the techniques are developed for enhancing images obtained from unmanned spacecraft's, space probes and military reconnaissance flights. Image Processing systems are becoming popular due to easy availability of powerful personnel computers, large size memory devices, graphics software's etc. Image Processing is used in various applications such as:

- Remote Sensing
- Medical Imaging
- Non-destructive Evaluation
- Forensic Studies
- Textiles
- Material Science.
- Military
- Film industry
- Document processing
- Graphic arts
- Printing Industry

The common steps in image processing are image scanning, storing, enhancing and interpretation. The schematic diagram of image scanner-digitizer diagram is shown in figure 1.



Methods of Image Processing

There are two methods available in Image Processing.

Analog Image Processing

Analog Image Processing refers to the alteration of image through electrical means. The most common example is the television image.

The television signal is a voltage level which varies in amplitude to represent brightness through the image. By electrically varying the signal, the displayed image appearance is altered. The brightness and contrast controls on a TV set serve to adjust the amplitude and reference of the video signal, resulting in the brightening, darkening and alteration of the brightness range of the displayed image.

Digital Image Processing

In this case, digital computers are used to process the image. The image will be converted to digital form using a scanner – digitizer [6] (as shown in Figure 1) and then process it. It is defined as the subjecting numerical representations of objects to a series of operations in order to obtain a desired result. It starts with one image and produces a modified version of the same. It is therefore a process that takes an image into another.

The term digital image processing generally refers to processing of a two-dimensional picture by a digital computer In a broader context, it implies digital processing of any two-dimensional data. A digital image is an array of real numbers represented by a finite number of bits.

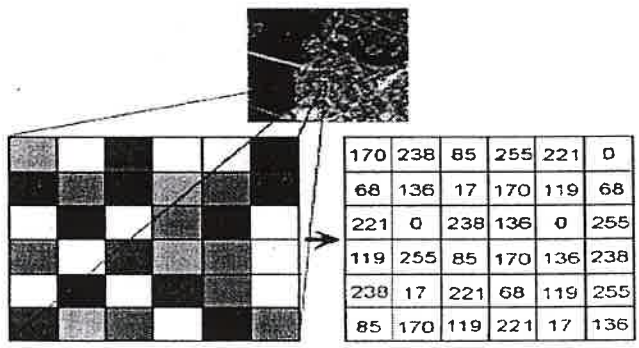
The principle advantage of Digital Image Processing methods is its versatility, repeatability and the preservation of original data precision.

The various Image Processing techniques are:

Image representation
Image pre-processing
Image enhancement
Image restoration
Image analysis
Image reconstruction
Image data compression

Image Representation

An image defined in the "real world" is considered to be a function of two real variables, for example, f(x,y) with f as the amplitude (e.g. brightness) of the image at the real coordinate position (x,y). The effect of digitization is shown in Figure 2.



170	238	85	255	221	0
68	136	17	170	119	68
221	0	238	136	0	255
119	255	85	170	136	238
238	17	221	68	119	255
85	170	119	221	17	136

Image Preprocessing

Scaling

The theme of the technique of magnification is to have a closer view by magnifying or zooming the interested part in the imagery. By reduction, we can bring the unmanageable size of data to a manageable limit. For resampling an image Nearest Neighborhood, Linear, or cubic convolution techniques are used.

Magnification

This is usually done to improve the scale of display for visual interpretation or sometimes to match the scale of one image to another. To magnify an image by a factor of 2, each pixel of the original image is replaced by a block of 2x2 pixels, all with the same brightness value as the original pixel.

Reduction

To reduce a digital image to the original data, every m^{th} row and m^{th} column of the original imagery is selected and displayed. Another way of accomplishing the same is by taking the average in 'm x m' block and displaying this average after proper rounding of the resultant value.

Image Analysis

Image analysis is concerned with making quantitative measurements from an image to produce a description of it. In the simplest form, this task could be reading a label on a grocery item, sorting different parts on an assembly line, or measuring the size and orientation of blood cells in a medical image. More advanced image analysis systems measure quantitative information and use it to make a sophisticated decision, such as controlling the arm of a robot to move an object after identifying it or navigating an aircraft with the aid of images acquired along its trajectory.

Image analysis techniques require extraction of certain features that aid in the identification of the object. Segmentation techniques are used to isolate the desired object from the scene so that measurements can be made on it subsequently. Quantitative measurements of object features allow classification and description of the image.

1. Image Segmentation

Image segmentation is the process that subdivides an image into its constituent parts or objects. The level to which this subdivision is carried out depends on the problem being solved, i.e., the segmentation should stop when the objects of interest in an application have been isolated e.g., in autonomous air-to-ground target acquisition, suppose our interest lies in identifying vehicles on a road, the first step is to segment the road from the image and then to segment the contents of the road down to potential vehicles. Image thresholding techniques are used for image segmentation.

2. Classification

Classification is the labeling of a pixel or a group of pixels based on its grey value. Classification is one of the most often used methods of information extraction. In Classification, usually multiple features are used for a set of pixels i.e., many images of a particular object are needed. In Remote Sensing area, this procedure assumes that the imagery of a specific geographic area is collected in multiple regions of the electromagnetic spectrum and that the images are in good registration. Most of the information extraction techniques rely on analysis of the spectral reflectance properties of such imagery and employ special algorithms designed to perform various types of 'spectral analysis'. The process of multispectral classification can be performed using either of the two methods: Supervised or Unsupervised.

In Supervised classification, the identity and location of some of the land cover types such as urban, wetland, forest etc., are known as priori through a combination of field works and topo sheets. The analyst attempts to locate specific sites in the remotely sensed data that represents homogeneous examples of these land cover types. These areas are commonly referred as TRAINING SITES because the spectral characteristics of these known areas are used to 'train' the classification algorithm for eventual land cover mapping of reminder of the image. Multivariate statistical parameters are calculated for each training site. Every pixel both within and outside these training sites is then evaluated and assigned to a class of which it has the highest likelihood of being a member.
In an Unsupervised classification, the identities of land cover types has to be specified as classes within a scene are not generally known as priori because ground truth is lacking or surface features within the scene are not well defined. The computer is required to group pixel data into different spectral classes according to some statistically determined criteria.

The comparison in medical area is the labeling of cells based on their shape, size, color and texture, which act as features. This method is also useful for MRI images.

1. Image Restoration
Image restoration refers to removal or minimization of degradations in an image. This includes de-blurring of images degraded by the limitations of a sensor or its environment, noise filtering, and correction of geometric distortion or non-linearity due to sensors.
Image is restored to its original quality by inverting the physical degradation phenomenon such as defocus, linear motion, atmospheric degradation and additive noise.

3. Image Reconstruction from Projections
Image reconstruction from projections [3] is a special class of image restoration problems where a two- (or higher) dimensional object is reconstructed from several one-dimensional projections. Each projection is obtained by projecting a parallel X-ray (or other penetrating radiation) beam through the object. Planar projections are thus obtained by viewing the object from many different angles. Reconstruction algorithms derive an image of a thin axial slice of the object, giving an inside view otherwise unobtainable without performing extensive surgery. Such techniques are important in medical imaging (CT scanners), astronomy, radar imaging, geological exploration, and nondestructive testing of assemblies.

4. Image Compression
Compression is a very essential tool for archiving image data, image data transfer on the network etc. They are various techniques available for lossy and lossless compressions. One of most popular compression techniques, JPEG (Joint Photographic Experts Group) uses Discrete Cosine Transformation (DCT) based compression technique. Currently wavelet based compression techniques are used for higher compression ratios with minimal loss of data.

Viva Question:

1. Define image processing.
The analysis and manipulation of a digitized image, especially in order to improve its quality.

2. State the applications of image processing.

1. Removing Straight Lines
2. Separating Aggregate of Objects
3. Detecting License Plate
4. Scanning Whiteboard Contents
5. Detecting Text in Still Images
6. Enhancing X-Ray Images
7. Removing Moiré Pattern from Scanned Photos
8. Extracting Urban Areas in Google Maps Aerial Images
9. Extracting Forest Areas in Google Maps Aerial Images
10. Extracting Agricultural Fields in Google Maps Aerial Images
11. Extracting Serous Cell Nuclei
12. Detecting Template in Image
13. Detecting Racing bib number

3. State some of the image processing techniques.

- Digital imaging
- Image analysis
- Image compression
- Image sharpening
- Image smoothing
- Multidimensional systems
- Near sets
- Photo manipulation

4. Define rendering?
In 3-D graphic design, rendering is the process of add shading, color and lamination to a 2-D or 3-D wireframe in order to create life-like images on a screen. Rendering may be done ahead of time (pre-rendering) or it can be done in on-the-fly in real time. Real-time rendering is often used for 3-D video games, which require a high level of interactivity with the player. Pre-rendering, which is CPU-intensive but can be used to create more realistic images, is typically used for movie creation.

5. What is Image Transform?
An image can be expanded in terms of a discrete set of basis arrays called basis images. These basis images can be generated by unitary matrices. Alternatively, a given NxN image can be viewed as an N^2×1 vectors. An image transform provides a set of coordinates or basis vectors for vector space.

STUDY OF PROGRAMMABLE LOGIC CONTROLLER

AIM:

To Study of Programmable Logic Controller

A Programmable Logic Controller is a device that a user can program to perform a series or sequence of events. These events are triggered by stimuli (called inputs) received at the programmable logic controller through delayed actions such as time delays or counted occurrences.

Once an event triggers, it actuates in the outside world by switching on or off electronic control gear or the physical actuation of devices. A Programmable Logic Controllers will continually loop through its user defined program waiting for inputs and giving outputs at the specific programmed times.

As you would imagine in the world of computers they have their own *language*. This language is used to program the Programmable Logic Controller can be used in three formats, ladder, instruction list and logic symbol.

Programmable Logic Controllers first came about as a replacement for automatic control systems that used tens and hundreds (maybe even thousands) of hard wired relays, motor driven cam timers and rotary sequencers.

More often then not, a single PLC can be programmed to replace thousands of relays and timers. These Programmable Logic Controllers were first befriended by the automotive manufacturing industry, this enabled software revision to replace the laborious re-wiring of control panels when a new production model was introduced.

Many of the earliest Programmable Logic Controllers expressed all decision making logic in a program format called Ladder Logic, which from its appearance was very similar to electrical schematic diagrams.

This of course was perfect for the electricians of the day, whom quite able to follow and trace out circuit problems with electrical schematic diagrams.

So using ladder logic became second nature to them allowing the electricians an relatively easy transition from hard wired circuits to software driven circuits.

This is the reason this program notation was chosen, to reduce training time for the existing technicians.

Other early Programmable Logic Controllers used an instruction list type form of programming, based on a stack-based logic solver. Which was far most difficult to master.

PROGRAM

A program is a connected series of instructions written in a language that the Programmable Logic Controller can understand. There are three forms of program format for PLC's these are Ladder, Instruction and SFC/STL. Not all programming tools can work with all programming formats.

Generally hand held programming panels only work with instruction format while most graphic programming tools work with both instruction and ladder format. Specialist programming software will also allow SFC style programming but that's for another time.

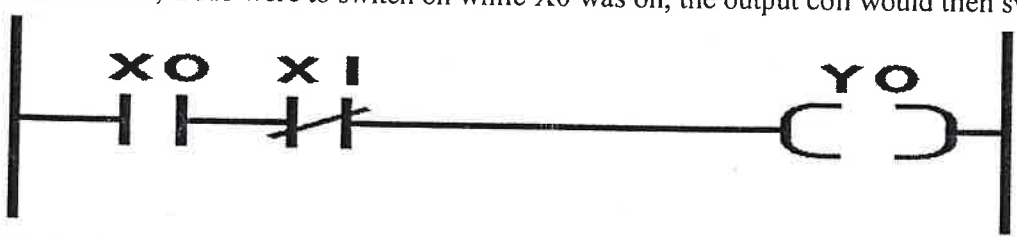
We will only be concerning ourselves with **Ladder Logic** programming here, because it's the most widespread in use today, probably because it's the easiest to grasp and get into the quickest.

Now, there's one big difference between a PLC and a PC type computer; as mentioned above, they only have one program to run. Unlike the PC, which is capable of running several programs at once within the Windows framework. Any of these could one or many many more of the different programs that could be installed on the PC. Why? In one word, speed.

A PLC will be designed to run its one program at a very fast speed, only branching out from within the main bit when an event happens. Events that happen in real time. This gives our little PLC beastie the ability to respond very quickly to any of the events under its control via an input.
Its response would then be carried out via an output. For example controlling a machines production running at 30,000 units an hour! Such as an offset web printing press churning out newspapers or book pages.

Ladder Logic, (the PLC programming language) is very closely associated to relay logic. In relay logic there are both contacts and coils that can be loaded and driven in different configurations. As there are in ladder logic, but a lot more configurations are possible. However the basic principal remains the same.
The program is written to switch the desired outputs for a given set of inputs energized. The 'hello world' program equivalent for a PLC would be a light bulb and a switch (see below). The switch is the input and the bulb would be controlled by the output. So, when the switch (input) is on, the bulb (output) is on.

A coil (relay logic terminology) drives outputs of the PLC (a 'Y' device, e.g. Y01) or drives internal coils ('M' device) timers, counters or flags. Each coil has associated contacts. These contacts are available in both *normally open* (NO) and *normally closed* (NC) configurations.
The term *normally* refers to the status of the contacts when the coil is **not** energized. Using a relay analogy, when the coil is off, a NO contact would have no current flow, that is, a load being supplied through a NO contact would not operate. However, a NC contact would allow current to flow, hence the connected load would be active.
Activating the coil reverses the contact status, that is, the current would flow in a NO contact and a NC contact would then inhibit the flow.
Physical inputs to the PLC (X devices) have no programmable coil. These devices may only be used in a contact format, again with NO and NC types available.
Because of the close relay logic association, ladder logic programs can be read as current flowing from the left vertical line to the right vertical line. This current must pass through the input (switch) configuration in order to switch the output coil Y0 on.
Therefore in the example below, switching X0 on and X1 being off would causes the output Y0 to also to switch on. However, if X1 were to switch on while X0 was on, the output coil would then switch off.



This is a very basic example of course, as they are very capable of automating a complete warehouse or running very complex machines on their own. Then, as you would imagine, the program it would be running would have many twists and turns to respond to the 10's and quite possibly even 100's of inputs

and outputs. These inputs in conjunction with the program would be dictating the on and off pattern of the outputs at any given time.

Here are just a few examples of Programmable Logic Controller programming applications that have been successfully completed and are in use today.

Manufacturing Industry
- Lead acid battery plant, complete manufacturing system
- Extruder factory, silo feeding control system

Travel Industry
- Escalator operation, monitored safety control system
- Lift operation, monitored safety control system

Aerospace
- Water tank quenching system

Printing Industry
- Offset web press print register control system
- Multistage screen washing system

Food Industry
- Filling machine control system
- Main factory feed water pump duty changeover system

Textile Industry
- Industrial batch washing machine control system
- Closed loop textile shrinkage system

Hospitals
- Coal fired boiler fan change
-over system

Film Industry
- Servo axis controlled camera positioning system

□ **Corrugating**
- Main corrugation machine control system
- BOBST platten press drives and control system

Plastics Industry
- Extruder factory, silo feeding control system
- Injection molding control system

Agriculture
- Glasshouse heating, ventilation & watering system

Foundry
- Overhead transportation system from casting process to shot blasting machine

Leisure
- Roller coaster ride and effects control system
- Greyhound track 'Rabbit' drive system

EX.NO: 1
DATE :

DESIGN OF CIRCUITS WITH LOGIC SEQUENCE USING ELECTRO-PNEUMATIC TRAINER KIT

AIM:

To design a simple electrical, hydraulic and pneumatic circuits using AUTOSIM software

SOTWARE USED:

- Autosim Software

COMPONENTS REQUIRED:

- AUTOSIM software
- Computer system

PROCEDURE:

1. Pneumatic circuit

- Draw the circuit diagram.
- Connect the compressor air to FRL unit
- Outputs of FRL unit connected to all components.
- Test the circuits by clicking 'RUN' button.
- Observe the working of cylinders.

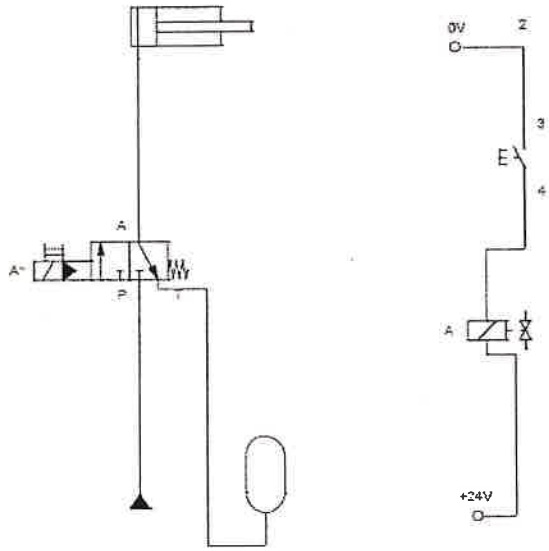
2. Hydraulic circuit

- Draw the circuit diagram
- Regulate the flow of compressed oil to all components
- Test the circuits by clicking 'RUN' button.
- Observe the working of cylinders.

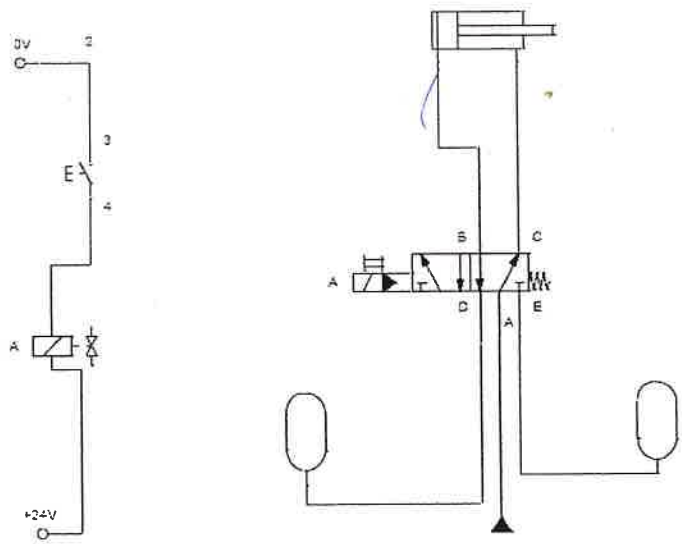
3. Electric circuit

- Draw the circuit diagram
- Connect the compressor air to FRL unit
- Outputs of FRL unit connected to all components.
- Make connections to switch the solenoid ON & OFF
- Test the circuits by clicking 'RUN' button
- Observe the working of cylinders.

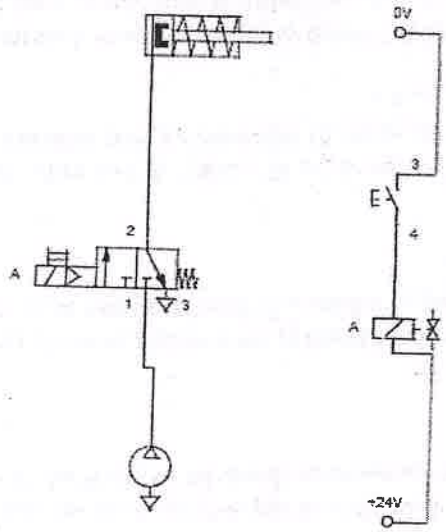
SINGLE ACTING HYDRAULIC CYLINDER



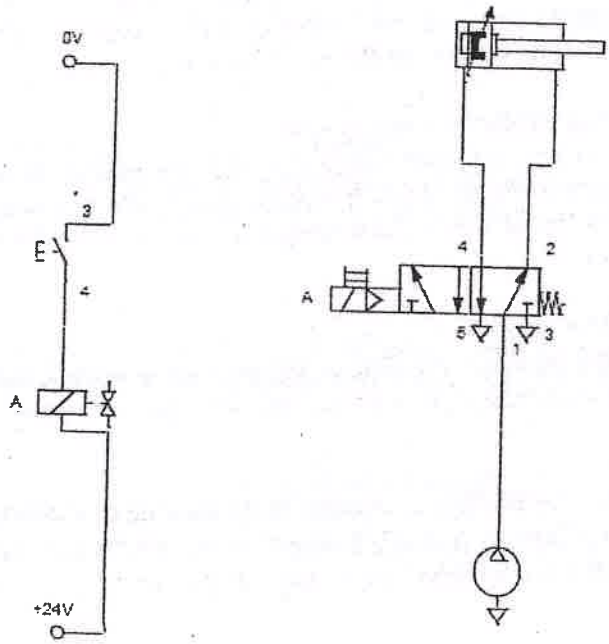
DOUBLE ACTING HYDRAULIC CYLINDER



SINGLE ACTING PNEUMATIC SYSTEM



DOUBLE ACTING PNEUMATIC SYSTEM



RESULT:

Viva Questions:

1. Define Hydraulic Circuit?
A **hydraulic circuit** is a system comprising an interconnected set of discrete components that transport liquid. The purpose of this system may be to control where fluid flows (as in a network of tubes of coolant in a thermodynamic system) or to control fluid pressure (as in **hydraulic** amplifiers).

2. Define Pneumatic Circuit?
A **pneumatic circuit** is an interconnected set of components that convert compressed gas (usually air) into mechanical work. In the normal sense of the term, the **circuit** must include a compressor or compressor-fed tank.

3. Define accumulator?
A **hydraulic accumulator** is a pressure storage reservoir in which a non-compressible **hydraulic** fluid is held under pressure that is applied by an external source. The external source can be a spring, a raised weight, or a compressed gas.

4. Define Fluid power?
Fluid power is the use of **fluids** under pressure to generate, control, and transmit **power**. **Fluid power** is subdivided into hydraulics using a **liquid** such as mineral oil or water, and pneumatics using a gas such as air or other gases.

5. List out the application of Fluid power
Machinery operated by fluid power covers a wide range of applications in industry. Mobile excavating equipment uses hydraulic systems. Automated production lines may use pneumatic or hydraulic systems to position work pieces or move tools. Variable-flow control valves and position sensors may be included in a servomechanism system for precision machine tools.

6. What are the needs of electro pneumatics?
Electro-pneumatic systems integrate pneumatic and electrical technologies into one system where the signal/control medium is electrical and the working medium is compressed air. In this type of system, devices like relays, solenoid valves, limit switches, and PLCs can be used to interface electrical control with pneumatic action.

7. Define Flow control valves?
A **flow control valve** regulates the **flow** or pressure of a fluid. **Control valves** normally respond to signals generated by independent devices such as **flow** meters or temperature gauges.

8. Define actuator?
An actuator is a type of **motor** that is responsible for moving or controlling a mechanism or system. It is operated by a source of energy, typically electric current, **hydraulic** fluid pressure,
or **pneumatic** pressure, and converts that energy into motion.

9. Define SPDT Switch?

SPDT. A **Single Pole Double Throw** toggle switch connects a common terminal to one or the other of two terminals. It is always connected to one or the other. The two outside terminals are never connected by the switch.

10. What is meant by FRL Unit?

As such, the use of air preparation devices, such as Filter Regulator Lubricator /**FRL Units** are an excellent means of keeping your air supply in top condition, as well as enabling your tools and equipment to operate at their peak performance.

EX.NO: 2.
DATE :

SIMULATION BASIC ELECTROPNEUMATIC CIRCUITS USING PLC

AIM:
To simulate the single acting cylinder and double acting cylinder using PLC ladder diagram

APPARATUS REQUIRED:
Compressor, FRL, Air Tubes, Single Acting Cylinder, Double Acting Cylinder, PLC, Versa Pro Software, 3/2 Single Solenoid, 5/2 Double Solenoid.

PROCEDURE:

- Draw the circuit diagrams.
- Provide +24V and -24V from PLC trainer to electro pneumatic with PLC panel.
- Output of the PLC (Q1, Q2) is direct connect to input solenoid valve
- Open the versa pro software in desktop
- Interface PLC with the system using RS232 cable
- Connect the air supply to FRL unit
- Any one output of FRL unit direct connect to choosing valve
- Check all circuits in panel and ladder diagram
- Run the PLC.

TRUTH TABLE

AND GATE

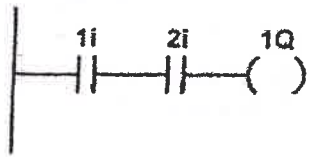
INPUT		OUTPUT
1i	2i	1Q
OFF	OFF	OFF
ON	OFF	OFF
ON	ON	ON
OFF	ON	OFF

OR GATE

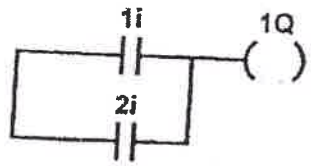
INPUT		OUTPUT
1i	2i	1Q
OFF	OFF	OFF
ON	OFF	ON
ON	ON	ON
OFF	ON	ON

LADDDER DIAGRAM:

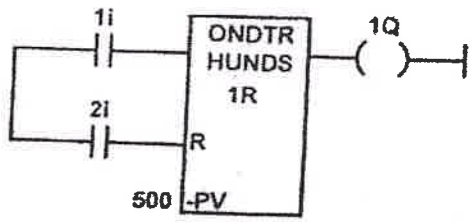
AND LOGIC



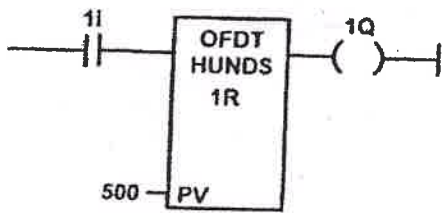
OR LOGIC



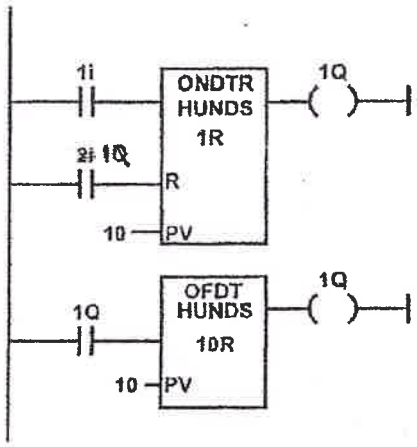
ON DELAY



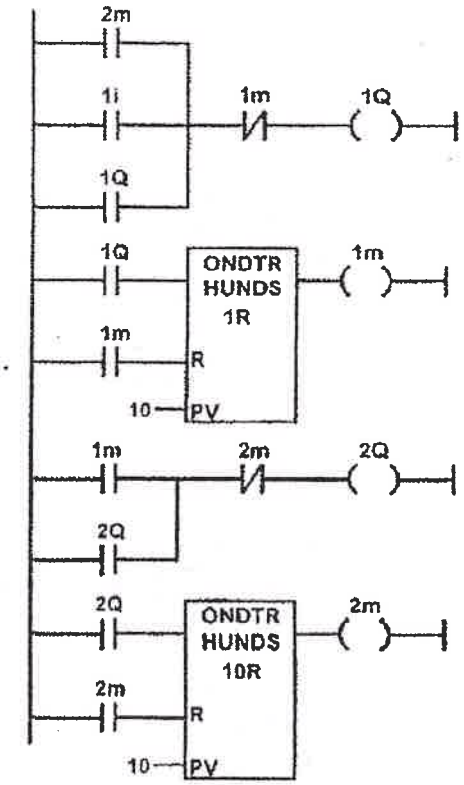
OFF DELAY



Ladder Diagram

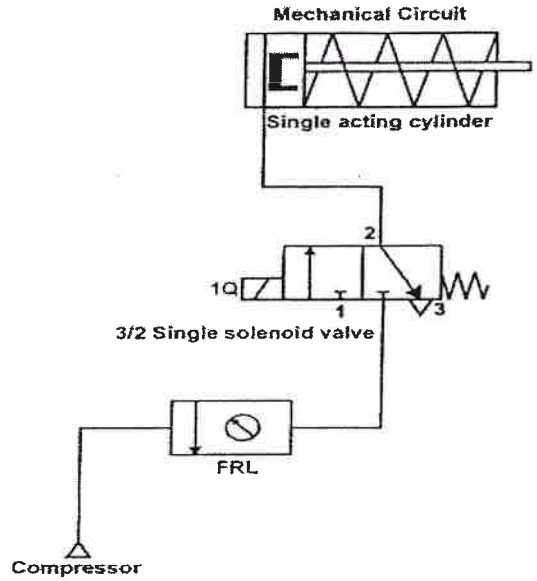


Ladder Diagram

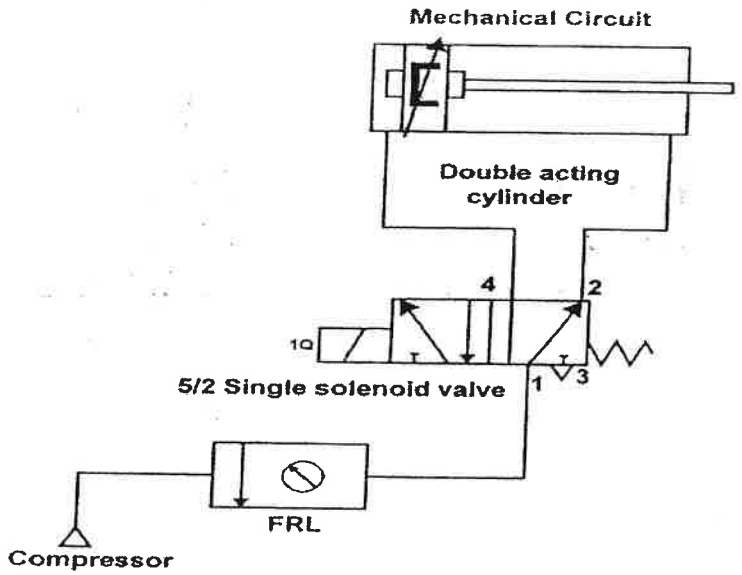


CIRCUIT DIAGRAM:

SINGLE ACTING CYLINDER



DDOUBLE ACTING CYLINDER



RESULT

Viva Question:

1. What is a PLC how is it useful in automated systems?
A PLC (i.e. Programmable Logic Controller) is a device that was invented to replace the necessary sequential relay circuits for machine control. The PLC works by looking at its inputs and depending upon their state, turning on/off its outputs. The user enters a program, usually via software, that gives the desired results. PLC acts as a controller in automated systems which are responsible for automatic controlling of various devices associated with the system.

2. Why are relays required in a PLC circuit?
Usually PLCs have low voltage at their outputs about 24 volts which are unable to operate devices of higher voltage ratings, in such cases the relays are used which are energized using PLC's outputs and relays themselves connect or disconnect devices from higher power sources.

3. Explain Timers and its types used in PLC programming.
TIMERS:
There are three fundamental types of timers.
TON – On delay timer
TOF – Off delay timer
RTO – Retentive on delay

4. Define ON delay Timers?
An on-delay timer will wait for a set time after a line of ladder logic has been true before turning on, but it will turn off immediately.

5. Define OFF delay Timer?
An off-delay timer will turn on immediately when a line of ladder logic is true, but it will delay before turning off.

6. Define Retentive ON delay?
An RTO function the same as a TON with the exception that once it has begun timing, it holds its count of time even if the rung goes false, a fault occurs or power is lost.

7. Explain different types of counters used in PLC programming.
COUNTERS:
There are two types of counters used:
CTU – count up
CTD – count down

CTU - This output instruction counts up for each false-to-true transition of conditions preceding it in the rung and produces an output when the accumulated value reaches the preset value.

CTD - This output instruction counts down for each false-to-true transition of conditions preceding it in the rung and produces an output when the accumulated value reaches the preset value.

8. What is latching how is it useful?

A latch is like a sticky switch - when pushed it will turn on, but stick in place, it must be pulled to release it and turn it off. A latch in ladder logic uses one instruction to latch, and a second instruction to unlatch, as shown in Figure. The output with an L inside will turn the output D on when the input A becomes true. D will stay on even if A turns off. Output D will turn off if input B becomes true and the output with a U inside becomes true (Note: this will seem a little backwards at first). If an output has been latched on, it will keep its value, even if the power has been turned off. The figure is shown in next page.

9. What are shift registers?

Shift registers Loads a bit of data into a bit array, shifts the pattern of data through the array, and unloads the last bit of data in the array. We use the shift register whenever we need to store the status of an event that had previously happened so that we can act upon it at a later time. This is accomplished by shifting either status or values through data files. Two types of shift registers are in use viz. BSL, BSR. The BSL shifts data to the left and the BSR shifts data to the right.

10. What are the basic components of a PLC?

There are five basic components in a PLC system:

The PLC processor or controller
I/O (Input /Output) modules
Chassis or backplane
Power supply
Programming software that runs in a PC
A network interface

11. Aplications of PLC?

Manufacturing Industry - Lead acid battery plant, complete manufacturing system - Extruder factory, silo feeding control system
Travel Industry - Escalator operation, monitored safety control system - Lift operation, monitored safety control system
Aerospace - Water tank quenching system
Printing Industry - Offset web press print register control system - Multistage screen washing system
Food Industry - Filling machine control system - Main factory feed water pump duty changeover system
Textile Industry - Industrial batch washing machine control system - Closed loop textile shrinkage system
Hospitals - Coal fired boiler fan change-over system
Film Industry - Servo axis controlled camera positioning system
Corrugating - Main corrugation machine control system - BOBST platten press drive and control system
Plastics Industry - Extruder factory, silo feeding control system - Injection moulding control system
Agriculture - Glasshouse heating, ventilation & watering system
Foundry - Overhead transportation system from casting process to shotblasting machine
Leisure - Roller coaster ride and effects control system - Greyhound track 'Rabbit' drive system

EX.NO:

DATE : **ADDITION OF TWO 8 BIT NUMBERS**

AIM:

To add two 8 bit numbers stored at consecutive memory locations

APPARATUS REQUIRED:

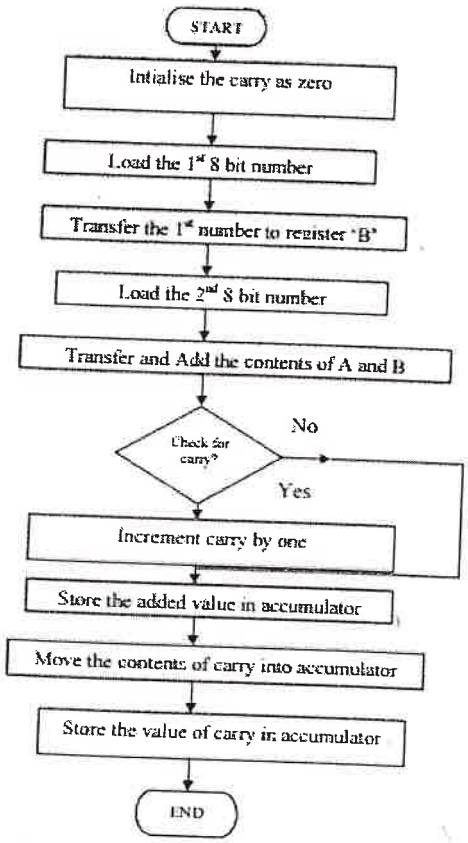
8085 Microprocessor Kit
5V Power Supply
Keyboard

PROGRAM:

```
MVI     C,00
LDA     4300
MOV     B,A
LDA     4201
ADD     B
JNC     LABEL1
INR     C
LABEL1: STA 4202
MOV     A,C
STA     4303
HLT
```

Address	Label	Mnemonics	Hex Code	Comments
4100		MVI C,00	OE, 00	Initialize the carry as zero
4102		LDA 4300	3A, (00, 43)	Load the first 8 bit data
4105		MOV, B,A	47	Copy the value of 8 bit data into register B
4106		LDA 4301	3A, (01, 43)	Load the second 8 bit data into the accumulator
4109		ADD B	80	Add the hoo values
410A		JNC	D2, 0E, 41	Jump on if no carry
410D		INR C	OC	If carry is there increment it by one
410E	Loop	STA 4302	32 (02, 43)	Stone the added value in the accumulator
4111		MOV A,C	79	More the value of carry to the accumulator from register C
4112		STA 4303	32 (03, 43)	Store the value of carry in the accumulator
4115		HLT	76	Stop the program execution

FLOWCHART:



ALGORITHM:

Step 1 : Start the microprocessor
Step 2 : Initialize the carry as 'Zero'
Step 3 : Load the first 8 bit data into the accumulator
Step 4 : Copy the contents of accumulator into the register 'B'
Step 5 : Load the second 8 bit data into the accumulator.
Step 6 : Add the 2 - 8 bit datas and check for carry.
Step 7 : Jump on if no carry
Step 8 : Increment carry if there is
Step 9 : Store the added request in accumulator
Step 10 : More the carry value to accumulator
Step 11 : Store the carry value in accumulator
Step 12 : Stop the program execution.

RESULT:

EX.NO:

DATE :

SUBTRACTION OF TWO 8 BIT NUMBERS

AIM:

To subtract two 8 bit numbers stored at consecutive memory locations

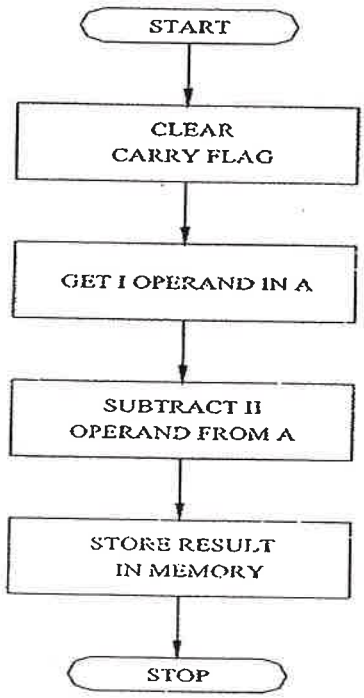
APPARATUS REQUIRED:

8085 Microprocessor Kit
5V Power Supply
Keyboard

PROGRAM:

```
MVI  C, 00
LDA  4300
MOV B, A
LDA  4301
SUB  B
JNC  LOOP
CMA
INR  A
INR  C
LOOP:       STA   4302
MOV A, C
STA  4303
HLT
```

Address	Label	Mnemonics	Hex Code	Comments
4100		MVI C,00	OE, 00	Initialize the carry as zero
4102		LDA 4300	3A, (00, 43)	Load the first 8 bit data into the accumulator
4105		MOV, B,A	47	Copy the value into register 'B'
4106		LDA 4301	3A, (01, 43)	Load the 2nd 8 bit data into the accumulator
4109		SUB B	90	Subtract both the values
410A	Loop	INC	D2, 0E, 41	Jump on if no borrow
410D		INR C	OC	If borrow is there, increment it by one
410E	Loop	CMA	2F	Compliment of 2nd data
410F		ADI, 01	C6, 01	Add one to 1's compliment of 2nd data
4111		STA 4302	32,02,43	Store the result in accumulator
4114		MOV A,C	79	Moul the value of borrow into the accumulator
4115		STA 4303	32,03,43	Store the result in accumulator
4118		HLT	76	Stop Program execution



ALGORITHM:

Step 1 : Start the microprocessor
Step 2 : Initialize the carry as 'Zero'
Step 3 : Load the first 8 bit data into the accumulator
Step 4 : Copy the contents of contents into the register 'B'
Step 5 : Load the second 8 bit data into the accumulator.
Step 6 : Subtract the 2 8 bit datas and check for borrow.
Step 7 : Jump on if no borrow
Step 8 : Increment borrow if there is
Step 9 : 2's compliment of accumulator is found out
Step 10: Store the result in the accumulator
Step 11: More the borrow value from 'c' to accumulator
Step 12: Store the borrow value in the accumulator
Step 13: Stop program execution

RESULT:

EX.NO:

DATE: **MULTIPLICATION OF TWO 8 BIT NUMBERS**

AIM:

To multiply two 8 bit numbers stored at consecutive memory locations

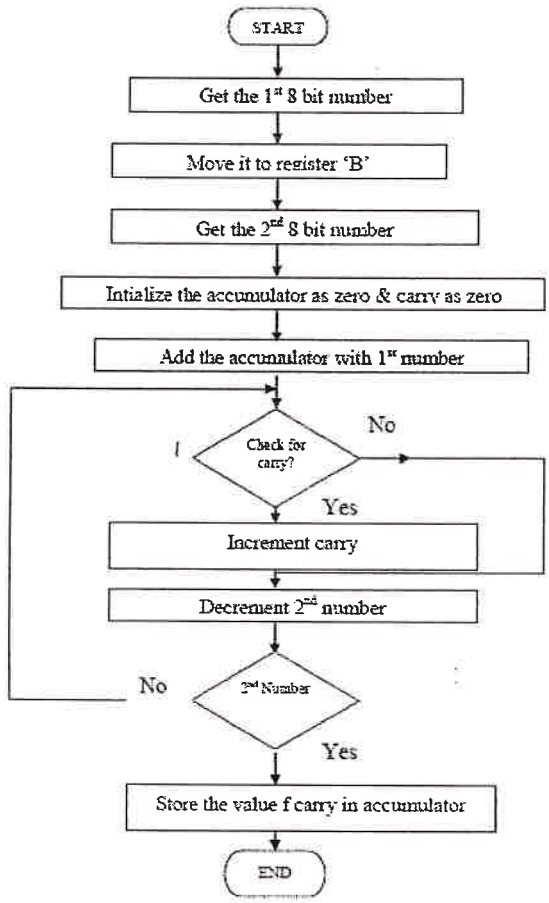
APPARATUS REQUIRED:

8085 Microprocessor Kit
5V Power Supply
Keyboard

PROGRAM:

```
MVI     C,00
LDA     4200
MOV     B,A
LDA     4201
MOV     A,D
MVI     A,00
LABEL:  ADD B
DCR     D
JNZ     LABEL
JNC     LOOP
INR     C
LOOP:   STA 4202
MOV     A,C
STA     4203
HLT
```

Address	Label	Mnemonics	Hex Code	Comments
4100		LDA 4500	3A, 00, 45	Load the first 8 bit number
4103		MOV B,A	47	Move the 1st 8 bit data to register 'B'
4104		LDA 4501	3A, 01, 45	Load the 2nd 16 it number
4107		MOV C,A	4F	Move the 2nd 8 bit data to register 'C'
4108		MVI A, 00	3E, 00	Intialise the accumulator as zero
410A		MVI D, 00	16, 00	Intialise the carry as zero
410C		ADD B	80	Add the contents of 'B' and accumulator
410D		INC	D2 11, 41	Jump if no carry
4110		INR D	14	Increment carry if there is
4111		DCR C	OD	Decrement the value 'C'
4112		JNZ	C2 0C, 41	Jump if number zero
4115		STA 4502	32 02, 45	Store the result in accumulator
4118		MOV A,D	7A	Move the carry into accumulator
4119		STA 4503	32,03,45	Store the result in accumulator
411C		HLT	76	Stop the program execution



Algorithm:

Step 1 : Start the microprocessor
Step 2 : Get the 1st 8 bit numbers
Step 3 : Move the 1st 8it number to register 'B'
Step 4 : Get the 2nd 8 bit number
Step 5 : Move the 2nd 8 bit number to register 'C'
Step 6 : Intialise the accumulator as zero
Step 7 : Intialise the carry as zero
Step 8 : Add both register 'B' value as accumulator
Step 9 : Jump on if no carry
Step 10 : Increment carry by 1 if there is
Step 11 : Decrement the 2nd value and repeat from step 8, till the 2nd value becomes zero.
Step 12 : Store the multiplied value in accumulator
Step 13 : Move the carry value to accumulator
Step 14 : Store the carry value in accumulator

RESULT:

EX.NO:

DATE : **DIVISION OF TWO 8 BIT NUMBERS**

AIM:

To divide two 8 bit numbers stored at consecutive memory locations

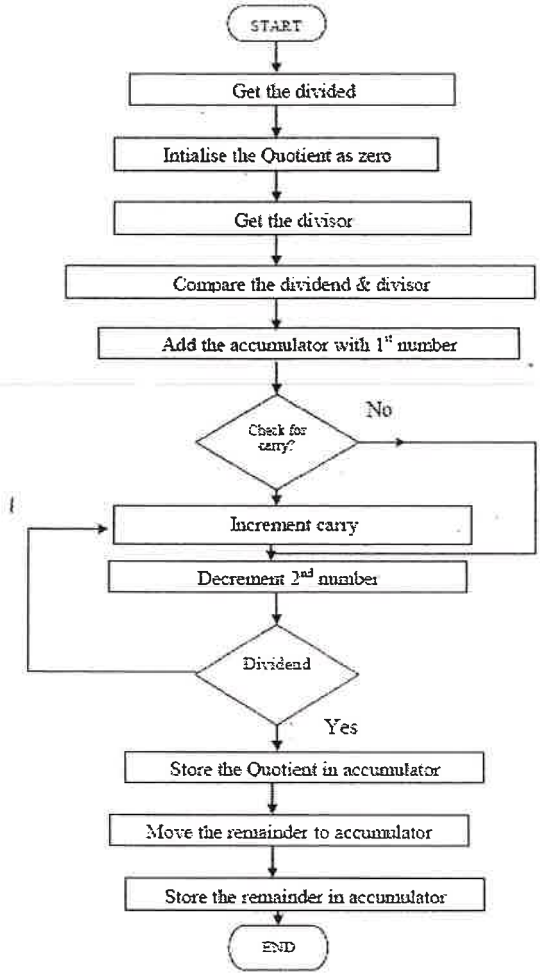
APPARATUS REQUIRED:

8085 Microprocessor Kit
5V Power Supply
Keyboard

PROGRAM:

```
MVI     C,00
LDA     4500
MOV     B,A
LDA     4501
LABEL:  SUBB B
INR C
JNC     LABEL
DCR     C
ADD     B
STA     4502
MOV     A,C
STA     4503
HLT
```

Address	Label	Mnemonics	Hex Code	Comments
4100		MVI C, 00	0E, 00	Initialise Quotient as zero
4102		LDA, 4500	3A 00, 45	Get the 1st data
4105		MOV B,A	47	Copy the 1st data into register 'B'
4106		LDA, 4501	3A 01, 45	Get the 2nd data
4109		CMP B	B8	Compare the 2 values
410A		JC (LDP)	DA 12,41	Jump if dividend lesser than divisor
410D	Loop 2	SUB B	90	Subtract the 1st value by 2nd value
410E		INR C	0C	Increment Quotient (410D)
410F		JMP (LDP, 41)	C3, 0D, 41	Jump to Loop 1 till the value of dividend becomes zero
4112	Loop 1	STA 4502	32 02,45	Store the value in accumulator
4115		MOV A,C	79	Move the value of remainder to accumulator
4116		STA 4503	32 03,45	Store the remainder value in accumulator
4119		HLT	76	Stop the program execution



Algorithm:

Step 1 : Start the microprocessor
Step 2 : Intialise the Quotient as zero
Step 3 : Load the 1st 8 bit data
Step 4 : Copy the contents of accumulator into register 'B'
Step 5 : Load the 2nd 8 bit data
Step 6 : Compare both the values
Step 7 : Jump if divisor is greater than dividend
Step 8 : Subtract the dividend value by divisor value
Step 9 : Increment Quotient
Step 10 : Jump to step 7, till the dividend becomes zero
Step 11 : Store the result (Quotient) value in accumulator
Step 12 : Move the remainder value to accumulator
Step 13 : Store the result in accumulator
Step 14 : Stop the program execution

RESULT:

1. What are the applications of microprocessors?

1. Calculators
2. Accounting system
3. Games machine
4. Complex Industrial Controllers
5. Traffic light Control
6. Data acquisition systems
7. Multi user, multi-function environments
8. Military applications
9. Communication systems

2. Define ALU?
An **arithmetic logic unit (ALU)** is a digital circuit used to perform arithmetic and logic operations. It represents the fundamental building block of the **central processing unit (CPU)** of a computer

3. Define accumulator?
In a computer's central processing unit (CPU), an accumulator is a register in which intermediate arithmetic and logic results are stored.

4. What are the general purpose registers of 8085?
In 8085 general purpose registers are used to hold data like any other registers, there are six types of special registers called general purpose registers, they are B, C, D, E, H and L.Each register can hold 8 bit data. Apart from above functions these registers can also be used to work in pairs to hold 16 bit data.

5. Define program counter?
A program counter is a register in a computer processor that contains the address (location) of the instruction being executed at the current time. As each instruction gets fetched the program counter increases its stored value by 1

6. What is microprocessor?
It is a program controlled semi conductor device (IC), which fetches, Decodes and execute instructions.

7. What is assembly language?
Assembly language is the symbolic representation of a computer's binary Encoding machine language. Assembly language is more readable than machine language because it uses symbols instead of bits. The symbols in assembly language Name commonly occurring bit patterns, such as opcodes and register specifies, so people can read and remember them

8. What is the function of ADD R?
This instruction adds the contents of register R to the contents of Accumulator and stored the obtained result accumulator. Example. - AAD B.

9. what is the function of ADD M?
This instruction adds the contents of the memory location addressed by HL pair to the contents of the accumulator and the result is stored in accumulator. Example. - ADD M

10. What is the function of ADC M?
This instruction adds the contents of memory location addressed by HL pair and carry flag to the contents of accumulator the result in the accumulator. EX. – ADC M.

EX.NO: **STEPPER MOTOR INTERFACING WITH 8051**

DATE : **MICROCONTROLLER FOR FULL STEP RESOLUTION**

AIM:

To interface and control the forward and reverse rotation of stepper motor using microcontroller 8051

APPARATUS REQUIRED:

- Stepper motor
- 8051-Microcontroller Kit
- Interfacing Bus card
- Power supply

PROCEDURE:

- Connect the power supply (25 pin D type connector) from the stepper motor module to microcontroller kit.
- Connect the 50 pin (FRC) cable to the microcontroller kit.
- Switch ON the microcontroller kit.
- 4 different programs written in the assembly language to check the characteristics of the stepper motor is given in the manual. Take one program at a time. Enter the program as given in the 8051 manual.
- Assemble the program.
- Execute the program, now the stepper motor will rotate.
- To stop the motor press 'RESET' button.
- Change the delay count to vary the speed of the stepper motor.
- Execute the program and check the speed of stepper motor.
- Similarly assemble other programs and check the motor operation.
- Full step program rotates the motor at 1.8 degrees per step. Half step program rotates the motor at 0.9 degrees per step.

A - Enter
4100

PROGRAM:
Different speed in two directions

4100	21 1A 41	START:	LXI	H,LOOK UP
4103	06 04		MVI	B, 04
4105	7E	REPT:	MOV	A,M
4106	D3 C0		OUT	0C0H
4108	11 03 03		LXI	D, 0303H
410B	00	DELAY	NOP	
410C	1B		DCX	D
410D	7B		MOV	A,E
410E	B2		ORA	D
410F	C2 0B 41		JNZ	DELAY
4112	23		INX	H
4113	05		DCR	B
4114	C2 05 41		JNZ	REPT
4117	C3 00 41		JMP	START
411A	09 03 06 0C	LOOK UP:	DB	09 05 06 0A

PROGRAM:
To run a stepper motor with required angle within 360 degree which is equalent to 256 steps.

1000	C6	C3	45		MOV	BL, 45
1003	C7	C7	20	10	MOV	DI, 1020
1007	C6	C1	04		MOV	CL, 04
100A	8A	05			MOV	AL, [DI]
100C	E6	C0			OUT	C0, AL
100E	E6	CB			DEC	BL
1010	74	0D			JZ	101G
1012	C7	C2	10	10	MOV	DX, 1010
1016	4A				DEC	DX
1017	75	FD			JNZ	1016
1019	47				INC	DI
101A	E2	F0			LOOP	100A
101C	E9	E8	FF		JMP	1003
101F	F4				HLT	
1020	09	05	06	0A	TABLE	09 05 06 0A

RESULT:

1. What are the applications of microprocessors?

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2. Accounting system
3. Games machine
4. Complex Industrial Controllers
5. Traffic light Control
6. Data acquisition systems
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10. What is the function of ADC M?
This instruction adds the contents of memory location addressed by HL pair and carry flag to the contents of accumulator the result in the accumulator. EX. – ADC M.

EX.NO: 7

DATE :

STEPPER MOTOR INTERFACING WITH 8051 MICROCONTROLLER FOR FULL STEP RESOLUTION

AIM:

To interface and control the forward and reverse rotation of stepper motor using microcontroller 8051

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- 8051-Microcontroller Kit
- Interfacing Bus card
- Power supply

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- Change the delay count to vary the speed of the stepper motor.
- Execute the program and check the speed of stepper motor.
- Similarly assemble other programs and check the motor operation.
- Full step program rotates the motor at 1.8 degrees per step. Half step program rotates the motor at 0.9 degrees per step.

A - Enter

4100

PROGRAM:
Different speed in two directions

4100	21 1A 41	START:	LXI	H,LOOK UP
4103	06 04		MVI	B, 04
4105	7E	REPT:	MOV	A,M
4106	D3 C0		OUT	0C0H
4108	11 03 03		LXI	D, 0303H
410B	00	DELAY	NOP	
410C	1B		DCX	D
410D	7B		MOV	A,E
410E	B2		ORA	D
410F	C2 0B 41		JNZ	DELAY
4112	23		INX	H
4113	05		DCR	B
4114	C2 05 41		JNZ	REPT
4117	C3 00 41		JMP	START
411A	09 03 06 0C	LOOK UP:	DB	09 05 06 0A

PROGRAM:

To run a stepper motor with required angle within 360 degree which is equalent to 256 steps.

1000	C6	C3	45		MOV	BL, 45
1003	C7	C7	20	10	MOV	DI, 1020
1007	C6	C1	04		MOV	CL, 04
100A	8A	05			MOV	AL, [DI]
100C	E6	C0			OUT	C0, AL
100E	E6	CB			DEC	BL
1010	74	0D			JZ	101G
1012	C7	C2	10	10	MOV	DX, 1010
1016	4A				DEC	DX
1017	75	FD			JNZ	1016
1019	47				INC	DI
101A	E2	F0			LOOP	100A
101C	E9	E8	FF		JMP	1003
101F	F4				HLT	
1020	09	05	06	0A	TABLE	09 05 06 0A

RESULT:

1. What is the use of stepper motor?

Stepper motors are DC motors that move in discrete steps. They have multiple coils that are organized in groups called "phases". By energizing each phase in sequence, the motor will rotate, one step at a time

2. State the principle of stepper motor.

Stepper motor is a specially designed DC motor that can be driven by giving excitation pulses to the phase windings. They cannot be driven by just connecting the positive and negative leads of the power supply. They are driven by a stepping sequence which is generated by a controller. The motor moves in steps according to this sequence.

3. List out the different types of stepper motor

Permanent magnet stepper.

Hybrid synchronous stepper.

Variable reluctance stepper.

4. How to calculate step angle of stepper

Step angle of the stepper motor is defined as the angle traversed by the motor in one step. To calculate step angle, simply divide 360 by number of steps a motor takes to complete one revolution

Step Angle ø = 360° / 4 = 90°

5. What are the applications of stepper motor?

Mechanical Machines – Stepper engines are utilized as a part of car gages and machine tooling mechanized creation supplies.

Security – new reconnaissance items for the security business.

Medicinal – Stepper engines are utilized inside restorative scanners, samplers, furthermore found inside advanced dental photography, liquid pumps, respirators and blood examination apparatus.

Buyer Electronics – Stepper engines in cameras for programmed advanced camera center and zoom cap.

EX.NO: 8

DATE :

SPEED CONTROL OF AC AND DC DRIVES

AIM:

Objective of this experimental work is to control the speed and position of AC and DC drives.

APPARATUS REQUIRED:

- AC position control kit
- AC motor
- DC position control kit
- DC motor

PROCEDURE:

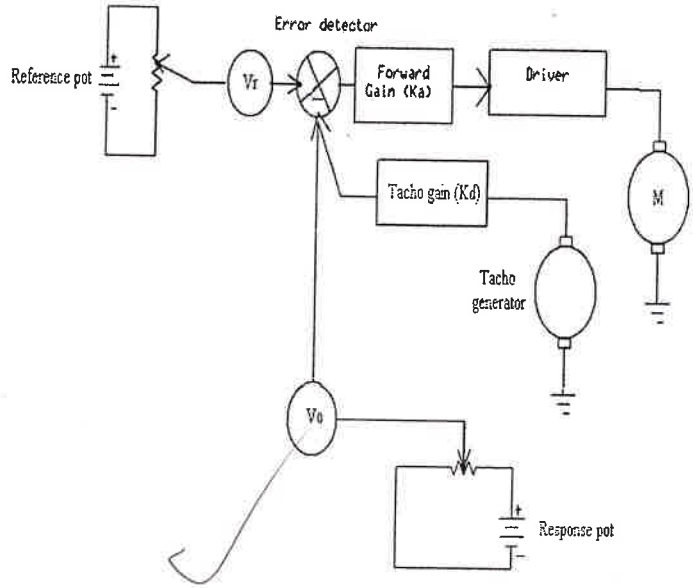
AC Drive:

- Switch on the Power supply.
- The controller Senses and brings the motor to 0^{o}.
- By pressing Angle + Switch vary the angle from 0^{o} to 360^{o} in steps (10^{o}).
- Note down the set angle in display, measured angle in the display and the practical O/P on the scale.
- Calculate the error.
- Draw graph set Angle Vs measured angle.

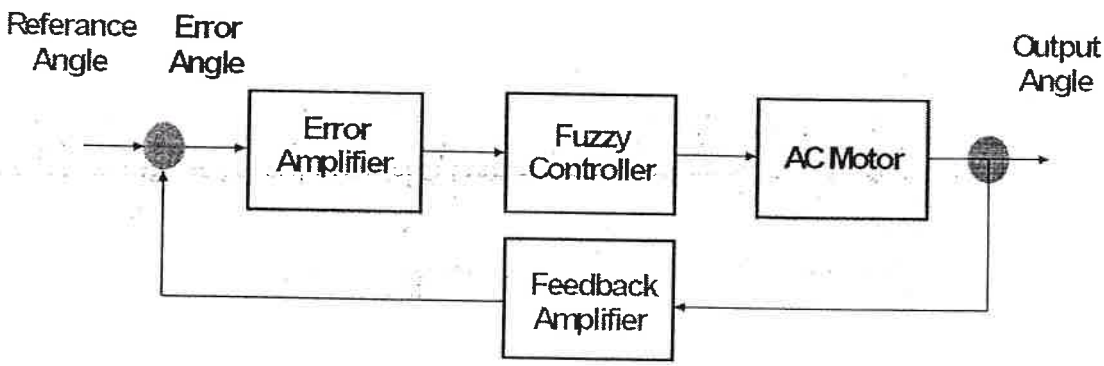
DC Drive:

- Switch on the Power supply.
- The controller Senses and brings the motor to 0^{o}.
- The desired position is set on the input potentiometer and the actual position is fed to feedback potentiometer.
- Note down the desired and actual angular position.
- With the use of Tachogenerator the actual voltage is measured which is proportional to speed of the motor.
- Calculate the error.
- Draw graph set Angle Vs Output angle.

DC POSITION CONTROL SYSTEM



AC POSITION CONTROL SYSTEM



AC POSITION CONTROL SYSTEM

RESULT:

Viva Question:

1. Define AC motor?
An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field.

2. What is the AC motor used for?
The AC Motor is used in the conversion of electrical energy into mechanical energy. This mechanical energy is made from utilizing the force that is exerted by the rotating magnetic fields produced by the alternating current that flows through its coils.

3. Define DC motor?
A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

4. Define fuzzy control?
A fuzzy control system is a control system based on fuzzy logic—a mathematical system that analyzes analog input values in terms of logical variables that take on continuous values between 0 and 1, in contrast to classical or digital logic, which operates on discrete values of either 1 or 0 (true or false, respectively)

5. What is meant by feedback in electronics?
Electronic feedback loops are used to control the output of electronic devices, such as amplifiers. A feedback loop is created when all or some portion of the output is fed back to the input. A device is said to be operating open loop if no output feedback is being employed and closed loop if feedback is being used.

6. Define closed loop control system?
A Closed-loop Control System, also known as a feedback control system is a control system which uses the concept of an open loop system as its forward path but has one or more feedback loops (hence its name) or paths between its output and its input.

7. What is an open loop control system?
One type of control system in which the output has no influence or effect on the control action of the input signal is called an Open-loop system. An "open-loop system" is defined by the fact that the output signal or condition is neither measured nor "fed back" for comparison with the input signal or system set point.

8. What is the control system?
A control system is a system of devices or set of devices, that manages, commands, directs or regulates the behavior of other device(s) or system(s) to achieve desire results. In other words the definition of control system can be rewritten as A control system is a system, which controls other system.

EX.NO: 09
DATE :

TRAFFIC LIGHT CONTROLLER

AIM:

To interface the DC motor with 8051 microcontroller to change the speed of the motor by changing the delay

APPARATUS REQUIRED:

- 8051 Microcontroller Kit
- 5V Power Supply
- Interfacing cable
- 8255 interfacing Kit
- Keyboard

PROCEDURE:

- Connect the 5V supply to the trainer kit.
- Connect the corresponding grounds.
- Interface the 8255 device with the microcontroller
- Switch on the power supply.
- Assemble the program and execute it.
- Check whether the LEDs work corresponding to the program.

PROGRAM:

Program for Microcontroller based Traffic light system using Micro - 51 EB.

```
4100                            org     4100h
FF0F            contrl          equ     0ff0fh
FF0C            porta           equ     0ff0ch
FF0D            portb           equ     0ff0dh
FF0E            portc           equ     0ff0eh
4100    7480                    MOV     A,#80h
4102    90FF0F                  MOV     DPTR,#contrl
4105    F0                      MOVX    @DPTR,A
4106    7C04            START:  MOV     R4,#04H
4108    90419B                  MOV     DPTR,#LOOK1
410B    AA83                    MOV     R2,DPH
410D    AB82                    MOV     R3,DPL
410F    90418F                  MOV     DPTR,#LOOK
4112    A883                    MOV     R0,DPH
4114    A982                    MOV     R1,DPL
4116            GO:
4116    E0                      MOVX    A,@DPTR
4117    A883                    MOV     R0,DPH
4119    A982                    MOV     R1,DPL
411B    90FF0C                  MOV     DPTR,#porta
411E    F0                      MOVX    @DPTR,A
411F    09                      INC     R1
4120    8883                    MOV     DPH,R0
4122    8982                    MOV     DPL,R1
4124    E0                      MOVX    A,@DPTR
4125    A883                    MOV     R0,DPH
4127    A982                    MOV     R1,DPL
4129    90FF0D                  MOV     DPTR,#portb
412C    F0                      movx    @dptr,a
412D    09                      INC     R1
412E    8883                    MOV     DPH,R0
4130    8982                    MOV     DPL,R1
4132    E0                      MOVX    A,@DPTR
4133    A883                    MOV     R 0,DPH
4135    A982                    MOV     R1,DPL
4137    90FF0E                  MOV     DPTR,#portc
413A    F0                      MOVX    @DPTR,A
413B    09                      INC     R1
413C    124175                  LCALL   DELAY
413F    8A83                    MOV     DPH,R2
4141    8B82                    MOV     DPL,R3
4143    E0                      MOVX    A,@DPTR
4144    AA83                    MOV     R2,DPH
4146    AB82                    MOV     R3,DPL
```

```
4148    90FF0C                  MOV     DPTR,#porta
414B    F0                      MOVX    @DPTR,A
414C    0B                      INC     R3
414D    8A83                    MOV     DPH,R2
414F    8B82                    MOV     DPL,R3
4151    E0                      MOVX    A,@DPTR
4152    AA83                    MOV     R2,DPH
4154    AB82                    MOV     R3,DPL
4156    90FF0D                  MOV     DPTR,#portb
4159    F0                      MOVX    @DPTR,A
415A    0B                      INC     R3
415B    8A83                    MOV     DPH,R2
415D    8B82                    MOV     DPL,R3
415F    E0                      MOVX    A,@DPTR
4160    AA83                    MOV     R2,DPH
4162    AB82                    MOV     R3,DPL
4164    90FF0E                  MOV     DPTR,#portc
4167    F0                      MOVX    @DPTR,A
4168    0B                      INC     R3
4169    124182                  LCALL   DELAY1
416C    8883                    MOV     DPH,R0
416E    8982                    MOV     DPL,R1
4170    DCA4                    DJNZ    R4,GO
4172    124106                  LCALL   START
4175    7D12        DELAY:      MOV     R5,#12H
4177    7EFF        L3:         MOV     R6,#0ffH
4179    7FFF        L2:         MOV     R7,#0ffH
417B    DFFE        L1:         DJNZ    R7,L1
417D    DEFA                    DJNZ    R6,L2
417F    DDF6                    DJNZ    R5,L3
4181    22                      RET
4182    7D12        DELAY1:     MOV     R5,#12H
4184    7EFF        L6:         MOV     R6,#0ffH
4186    7FFF        L5:         MOV     R7,#0ffH
4188    DFFE        L4:         DJNZ    R7,L4
418A    DEFA                    DJNZ    R6,L5
418C    DDF6                    DJNZ    R5,L6
418E    22                      RET
418F    44 27 12    LOOK:       DB      44H,27H,12H
4192    92 2B 10                DB      92H,2BH,10H
4195    84 9D 10                DB      84H,9DH,10H
4198    84 2E 48                DB      84H,2EH,48H
419B    48 27 12    LOOK1:      DB      48H,27H,12H
419E    92 4B 10                DB      92H,4BH,10H
41A1    84 9D 20                DB      84H,9DH,20H
41A4    04 2E 49                DB      04H,2EH,49H
                                END
```

RWSULT:

Go Space 4100

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Viva Question:

1. Define Microprocessor?

An integrated circuit that contains all the functions of a central processing unit of a computer.

2. What is the difference between a microprocessor and a CPU?

A CPU (central processing unit) is the part of a computer that executes instructions. This can be implemented using a single IC, a number of ICs, discrete transistors or a room full of vacuum tubes. A microprocessor is a single-chip implementation of a CPU

3. Why microprocessor is faster than microcontroller?

As all the peripheral of microcontroller are on single chip it is compact while microprocessor is bulky. Processing speed of microcontrollers is about 8 MHz to 50 MHz, but in contrary processing speed of general microprocessors is above 1 GHz so it works much faster than microcontrollers.

4. Define Traffic light control?

Traffic lights, which may also be known as stoplights, traffic lamps, traffic signals, signal lights, robots or semaphore, are signaling devices positioned at road intersections, pedestrian crossings and other locations to control competing flows of traffic.

5. Define Interface?

A device or program enabling a user to communicate with a computer.