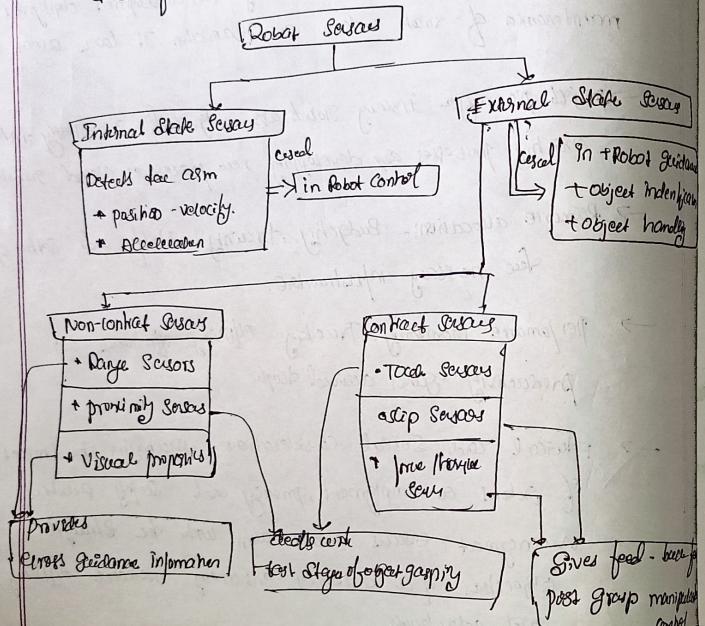


Assignment - 2

Q) consider a Block diagram consti. due classifications of Sensors
describ functions



2) Explain tooth Sensors:-

The touch sensors gather the information established by the contract between the parts to be handled and the fingers in the manipulators and effectors. The signals of touch informations are crafted in

- * locating the objects
 - * recognising the object type.
 - * force and torque control needed for task manipulation

The types of Touch Sensors are:-

- i) Binary search detect the existence of the object to be searched for example - microsecondies and second secondies.

- 2) Analog Sensors produce proportional output Signals for the force detected (example: a case wheel with a plunger)

3) Explain binary Sendors under attack:

The device first derives Sensity Signal by lenslet at two
Sighting points are formed due binary Senses. The figure shows it.
Accommodates due binary Senses. The lenslet with due pairs result in
deflection and due information is sufficient to determine the presence
of due object features due to pairs

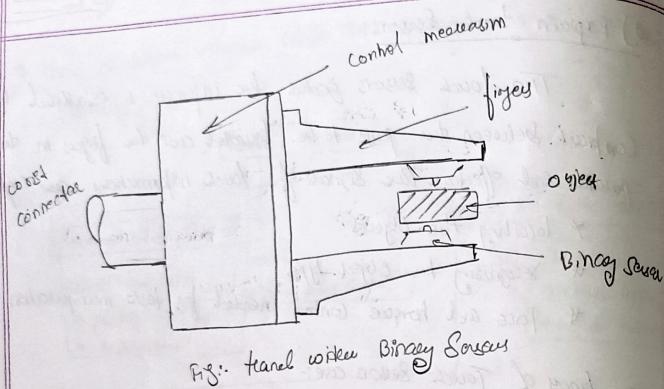
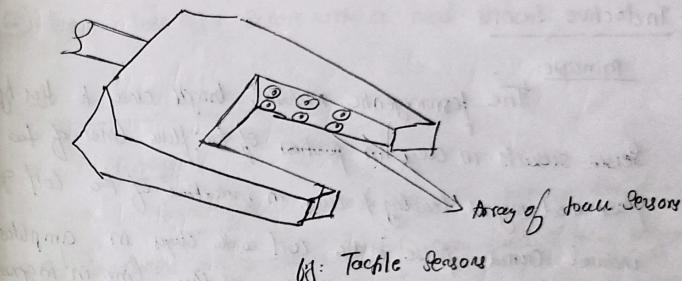
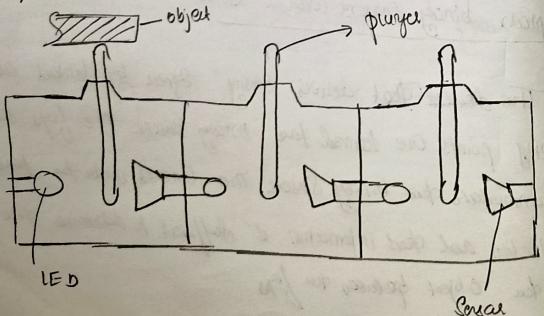


Fig: Hand with Binary Sensors

4) Explain tactile Sensors with a neat sketch:

An array of touch sensors arranged symmetrically to provide information about the contact of the fingers with the object. & Contactless tactile Sensors like special tactile Sensors also provide additional information like shape, size and the type of material of the object.



(b) Tactile Sensors

Each element in array (Tactile Sensor) does one functional part.

A plunger or LED act a light sensing device. The structure is as follows. The movement of the plunger operates the LED and the light sensor gives output signal accordingly.

5) Explain proximity Sensors with a neat sketch:

The output of the proximity sensor gives an indication of the presence of an object within in the vicinity. Job operations: In robotics these sensors are used to generate information of object grouping and obstacle avoidance. This section deals with some of the important proximity sensors and its working.

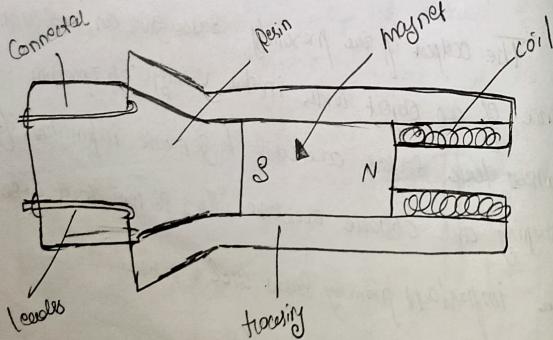
Inductive Sensors:-

Principle:-

The ferromagnetic material brought close to the ferromagnetic core in position of the flux lines of the permanent magnet leading to change in inductance of the coil. The induced current pulse in the coil with change in amplitude. Shape is proportional to shape of change of flux line in magnet.

Construction

The proximity inductive sensor basically consists of a wound coil located in front of a permanent magnet enclosed inside a metal housing. The leads from the coil, embedded in resin is bonded to the assembly through a connector. The schematic of a proximity sensor is shown below.



6) Explain Hall effect sensors with a neat sketch

Hall effect Sensors

Principle:-

Hall effect deals with the voltage between the two points in a conductor which changes by the new field of the magnetic field in a ferromagnetic material. The sensor experiences a weaker magnetic field in the close proximity of a ferromagnetic material. The basic theory of the Hall effect sensor is shown below.

E.R. Hall in 1879 discovered Hall effect. which states "A beam of charged particles passing through a magnetic field experiences a force that deflects the beam from the straight line path".

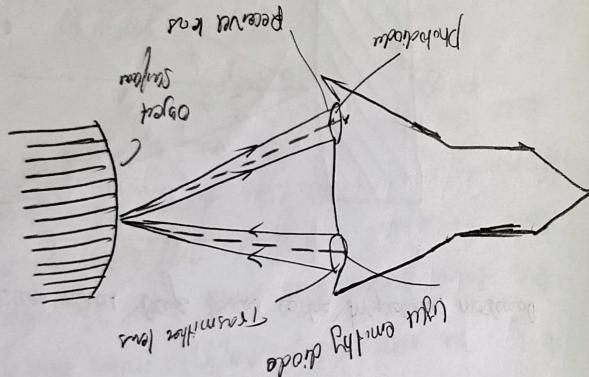
Electrons (negative charged particle) are made to pass through a plate magnetized in shape and a magnetic field of constant strength. The electrons are at right angle to the plane of plate as shown. The electrons are deflected towards one side of the plate moving with negative charged and others moving with positive charge. The force due to applied magnetic field is known as Lorentz force. The motion of deflection is governed by the relation of Lorentz force and force on the beam of

Electron

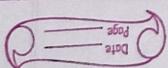
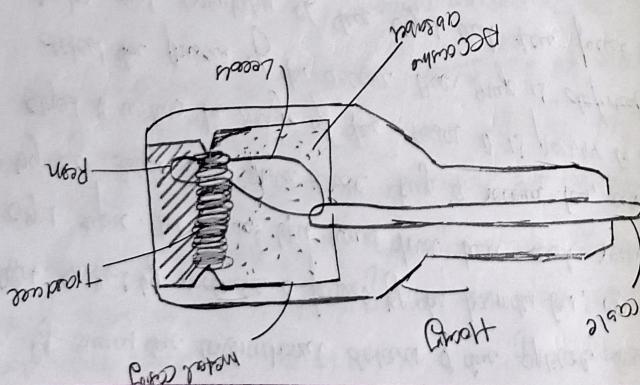
the glass towards the object.

The wave can be focused and the distance can be varied by changing the object if detected by the action of the wave itself.

Practical Application



Explain what exactly occurs inside to read sensor



The main part in this type of sensor is the transducer which is made of piezoelectric material. This material can convert mechanical energy into electrical energy. When an alternating voltage is applied across the transducer, it vibrates at a certain frequency. These vibrations produce sound waves that travel outwards from the transducer. When these waves encounter an object, they are reflected back towards the transducer. The transducer converts these reflected waves back into electrical signals. These signals are then processed by an electronic circuit to determine the distance to the object.

Obstacles

The primary obstacle faced by these sensors is clutter or noise. Clutter refers to false reflections from nearby objects that are not the intended target. Noise refers to random fluctuations in the signal that can be caused by various factors such as temperature variations or interference from other sources. To overcome these challenges, modern ultrasonic sensors use advanced signal processing techniques like beamforming and time-of-flight measurement to accurately detect the target object while ignoring clutter and noise.

④ Explain ultrasonic sensor using gate pulse and start pulse

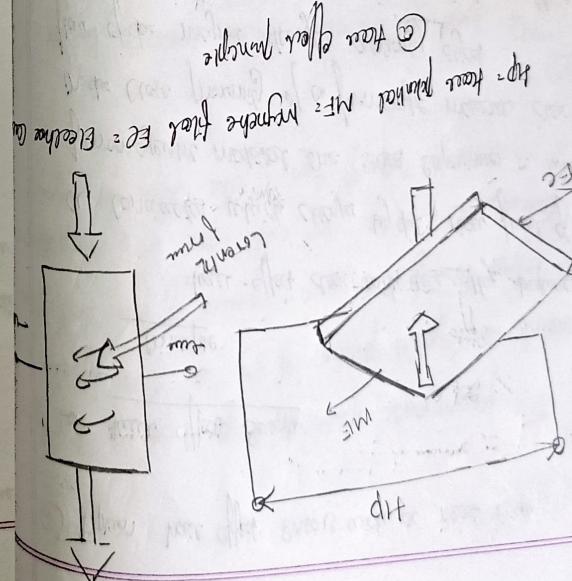
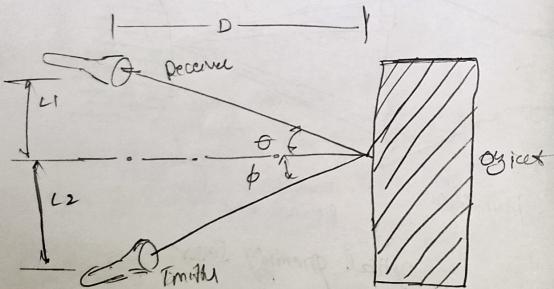


Fig. shows the constructional details of the optical system. After emitted by a diode, is focused by the bimorph lens, on to the object surface. The detected light waves travel back and received by the Solid State Photo diode through a receiver lens, when the object is within the range of the sensor it is possible to detect the position of the object. The range is defined by detecting the presence of the object and the focal length of the focal lenses.

- ⑨ Discuss about Graye. Seagles corseae frigidae hinc modicem



The distance between the object and the robot hand is measured using the depth sensors contained in the robot's grippers. The calculation of the distance is by visual processing. Depth sensors find use in robot navigation and

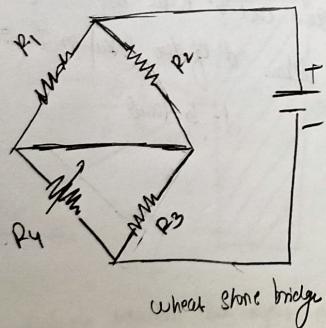
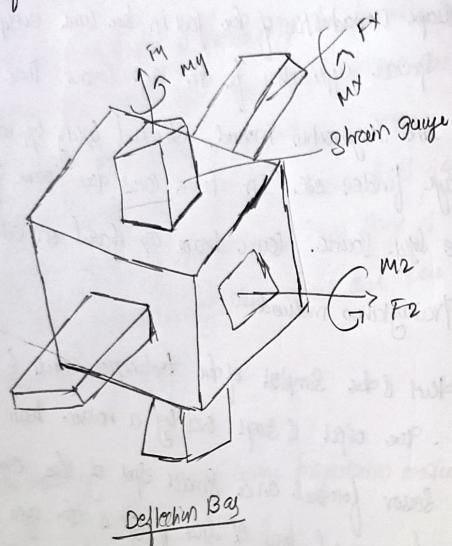
workarea of the obstacles in the path. The exact location and the general shape characteristics of the path in the work cycle of the robot is done by. Special applications for the robot. These are several approaches like triangulation method, Structured Safety Approach and line of sight ray finding etc. In these cases the source of illumination can be light source. Laser beam or based on ultrasonic

→ *Traeiclytulus medvedi*

→ Mercury mirror method
 It is the simplest of the techniques which is easily demonstrated
 in Fig. The object is swept over by a narrow beam of sheep's Gla.
 The sensor focused on a small spot of the object surface.
 If 'O' is the eye made by the reflected beam of light and 'd' is the distance between source and the
 illuminating source and 'b' is the distance between source and the
 sensor. The distance 'd' of the sensor on the grid is given as

$$d = b \cdot \tan \theta$$

⑩ Explain force and torque. Solved with a neat sketch



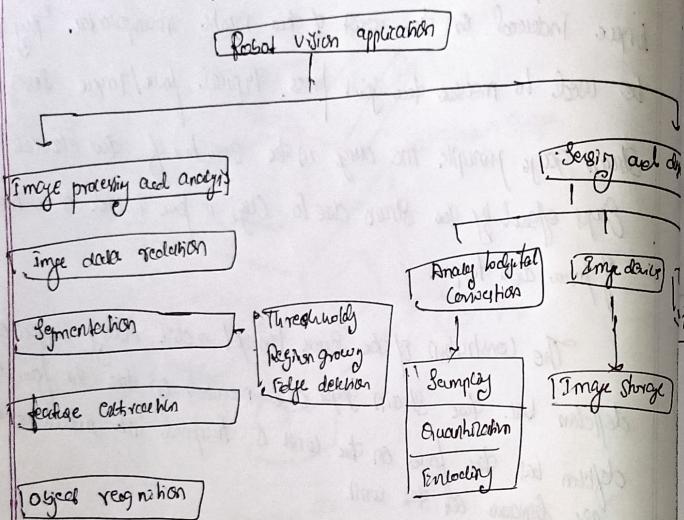
The wrist force sensor shown in fig. It used to measure the force and torque induced on the wrist of the robotic manipulator. They can also be used to measure the joint forces. Typical force/torque sensor work on strain gauge principle. The change in the resistance of the electrical strain gauge offered by the strain due to change in force induced as a measure of force and torque.

The construction of the beam has got a stiff hinging support and a deflection bed. The strain gauges are mounted on the six faces of the beam bed. The force on the width is transformed into mechanical deflections and disappear at the width.

A balanced Wheatstone bridge is used to arrange the galvanometer connected between one of the wires equal potential. The galvanometer shows zero deflection. When there is no force applied, the force on the Shear zero deflection. When there is no force applied, the force on the Shear zero deflection. When there is no force applied, the force on the Shear zero deflection. When there is no force applied, the force on the Shear zero deflection. When there is no force applied, the force on the Shear zero deflection.

$$\text{dry steam is given by} \quad \frac{P_1}{P_{c1}} = \frac{P_2}{P_{c3}}$$

1) write a block diagram of vision system



2) Image processing and Analysis:

* Image Data Reduction: - Techniques to reduce image complexity

* Segmentation: - Divides an image into regions of objects using

- * Thresholding
- * Region Growing
- * Edge Detection

* Feature Extraction: - Identifies essential features from segmented data.

* Object Recognition: - Classifying and identifying objects by

3) Sensing and digitizing

* Analog to digital conversion

→ Sampling

→ Quantization

→ Encoding

* Image Device: Captures and stores image data

* Coding Technique: Enhances image quality of processing

4) what do you understand by the term "robot vision" explain its principal functions and functional description in detail

The process of deriving feature and analysis are derived from the three dimensional object in the form of a picture is known as Robot Vision. As application utilizes computer to process it is also known as Computer Vision. The area of processing and analysis of the image are categorized as follows

Principal functions of functional description

* Sensing: - The process that describes and gives out visual image

* Preprocessing: - Deals with the process of disturbance reduction and image development

* Segmentation: - Is associated with the technique of dividing the image into parts of need

- Description: Distinguish the parts of beam from tube's other parts by comparison of its image feature.
- Recognition: By identifying shape which is part like spirals, bold and numbers are recognized.
- Interpretation: In this process the recognized objects are given meaningful meaning for file operation.

Q13 Define the construction features of Vidicon Camera and explain their working principle of it in detail.

* Construction features of Vidicon Camera:

- lens: focuses the image of the object onto the camera.
- Face plate: glass over at front end of camera.
- Transparent metal coating: acts as electrode which delivers electrical video signal.
- Photo sensitive layer: is a layer of resistive material whose resistance is inversely proportional to light intensity.
- wire mesh: Decelerate the beam of electrons so that they meet photo sensitive layer with velocity.
- Electron gun: generates beam of electron which slows down the photo sensitive layer.

beam deflection coil: - Deflects the beam of electrons vertically and horizontally for scanning.

beam focusing coil: The electron beam is focused by this coil.

Tube pins: Act as connector to the electric supply source.

Glass envelope: provides a housing for the elements.

Working principle of vidicon Camera

- The metal coating of the faceplate is applied with positive voltage.
- The photo sensitive layer acts like a capacitor with negative charge on the inner surface and positive charge on the opposite side, as electron beam strikes.
- The light striking the photo sensitive layer creates free electrons and free holes. Free holes and neutralize the positive charge.
- As the image is formed on the spot by the concentration of electrons is high in dark areas and low in bright areas.
- The electrons so formed from photo metal layer act like the base pins.
- Variation in current along the electron beam scanning makes produce a variation in current along the electron beam scanning makes produce a Video signal proportional to the intensity of input image.

14. Explain in detail analog to digital conversion

The imaging device like video camera gives analog signal denoting three dimensional image of the object. This information about the image be stored in the bit memory of the computer by converting it to digital form. Digital conversion of the analog signal is an approximation of greatly with minor loss using a analog to digital (A/D) converter. But process has three steps:

- (1) Sampling
- (2) Quantization
- (3) Encoding

* Sampling:

If the function $f(x,y)$ denote the two-dimensional image, then in the image device, the geometric co-ordinates x and y of the image plane describes the set information by the process known as Image Sampling.

After Sampling, the digitized function (say) in the Spatial Co-ordinates of Space which can be easily stored in the computer memory. Assume,

* Quantization:

The digitized amplitude of the image function (say) depends on the intensity of the pixel is known as Quantization.

The number of quantization level

$$Q = 2^n$$

where n is the number of memory bits in the A/D converter.

The Quantization level spacing is given as

$$L = \frac{F_r}{Q}$$

where F_r = full scale range of the camera in volts
from equations (10) and (11)

$$L = \frac{F_r}{2^n}$$

The digital approximation of the analog signal gives the bits in quantizer as Quantization cell. $Q_a = \pm \frac{1}{2}(L)$

$$Q_a = \pm \frac{1}{2} \left(\frac{F_r}{2^n} \right)$$

Encoding:

Depending on the image created on the display of the camera, the intensity of the different pixels would be different. The conversion into the digital code of the amplitude levels follows the process of quantization. The digital amplitude of the amplitude levels follows the binary sequence of digits, which is known as binary code is represented by the binary sequence of digits, which is known as binary code. The digital quantization levels follow the difference in intensity and the amplitude levels. All zero is the binary sequence of digits represent data (values) intensity level zero. One in the bit memory is the representation of bright (white) intensity pixel. In between there are combinations of zeros and ones known as gray colors.

(15) what is image storage explain image processing and analysis in detail

* Image Storage: The storage of image (digitized) in the computer memory is done by the frame buffer which can be made a part of the computer or frame grabber. The more popular frame grabber technique can be explained.

Image processing and analysis:

In the industrial applications the algorithms and programs are developed to process the image captured, digitized and stored in the computer memory. The size of data to be processed is huge. of the order of 10^6 which is to be substantially reduced in % to handle the different and time consuming task of processing is handled effectively by the following techniques

- 1) Image data reduction
- 2) Segmentation
- 3) Feature extraction
- 4) Object recognition.

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Explain Segmentation in detail

* Segmentation: The segmentation defines distinct parts of the entities. data are grouped into areas of similar characteristics & known as segments. The major segments of the images are regions and edges. Segmentation is different from the thresholding. The image processing and analysis can be explained by the following segmentation techniques

- ① Edge detection
- ② Region growing
- ③ Thresholding

Edge detection:

At boundary the pixels on the opposite sides in every local context are stored in the compact in the binary form. This is the distinguishing feature of the object image. The features of similar region at the edges does demand a very large area of the analysis. The edge detection is based on following procedure.

Region growing & the processing techniques were grid elements processing. Similar

elements are grouped to form a region. The grid elements are certain of pixels certain attributes are grouped to form a region. The region grows based on the features of the object image and the background formed on the features. The process and called Spatial features co-ordinates of a region based on the process of map a region to be independent as a separate entity. The region growing procedure can be depicted

Explain object recognition from vision point of robotics

One of the major approaches in image processing in the techniques of matching the captured image with the object to be recognized. The technique of object recognition is based on the feature extraction described previously. The powerful algorithms are used for few papers the features and which are

- * Template matching
- * Structural Technique

⑧ Explain with Block diagram Components of digital image processing

