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## 1). SENSORS AND ACTUATORS <sup>FOR</sup> BIOMEDICAL APPLICATION

**Sensors:** Sensors are devices which provide a usable output in response to a specified measurand. Many different kinds of sensors can be used in biomedical application.

They are classified into physico-physical, and chemical sensors. (In the case of physical sensors, quantities such as geometric, mechanical, thermal and hydraulic variables are measured. (In biomedical applications, these variables can include things such as muscle displacement, blood pressure, core body temperature, blood flow and bone growth velocity.

(In the case of chemical sensors, chemical quantities such as identifying the presence of chemical composite, monitoring the chemical activities in the body for diagnostic and therapeutic application. Examples of sensors are for biomedical application are heart sound sensor, blood flow sensor, respiration sensor and blood pressure sensor.

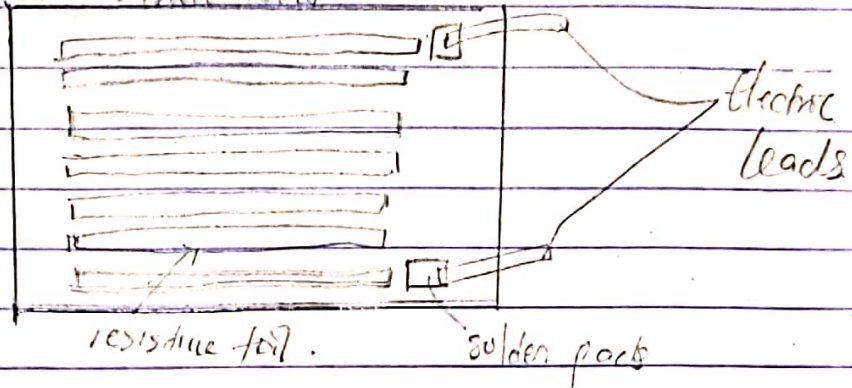
**Actuators:** They are for changing over different types of energy for example, physical energy into <sup>mechanical</sup> motion in response to different natural stimuli, such as pH, heat, or moisture. They are known for their accurate control. Actuators are used in medical beds to raise and lower the beds - linear actuators are used in hospital lifts to control their movements.

## 2). COMPONENTS OF A BASIC MEASURING INSTRUMENT

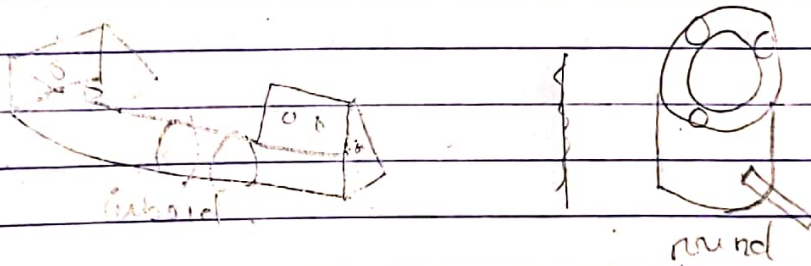
1) **Strain Gages:** These consist of a very fine metallic foil etched in a grid pattern, which is bonded to a device and used to measure the strain, or amount of deformation of the devices when pressure or weight is applied.

Gage

Strain detector.



ii) Load Cells : Manufactured load cells use strain gages to convert weight into electrical output.

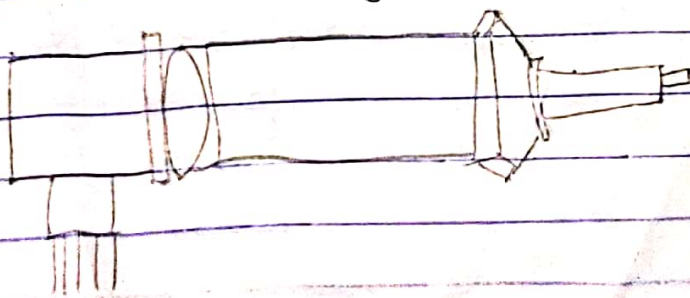


load cells.

iii) Force Sensors : These are sensors for mass produced that uses strain gages.

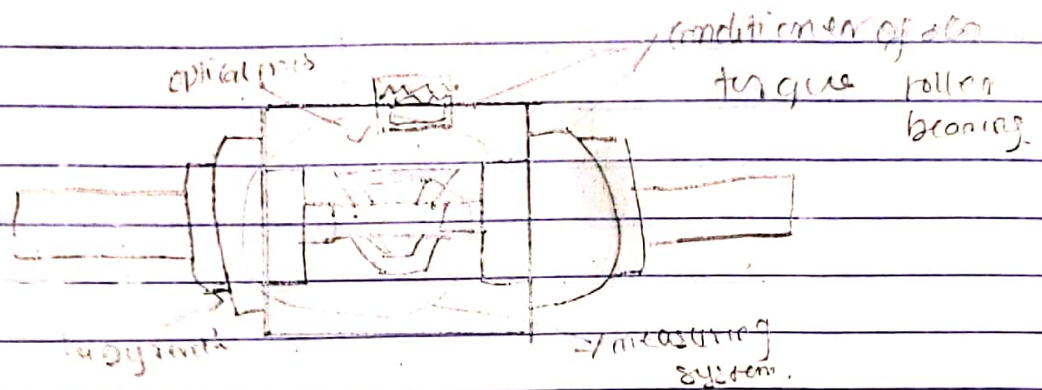


iv) Pressure Sensors : Using strain gages, these pressure sensors are sensors that measure pressure as electric signals.

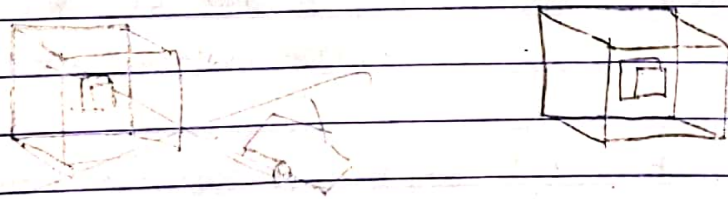




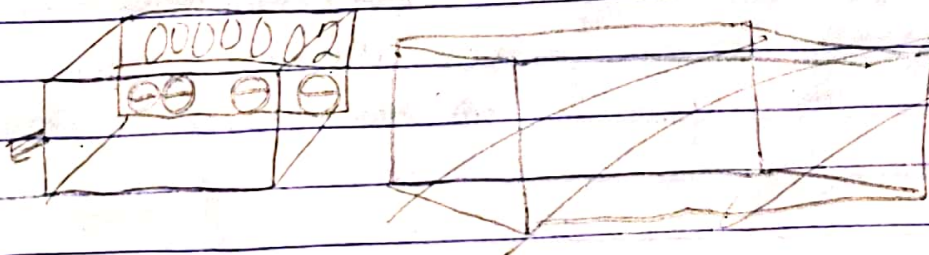
v) Torque Transducers: The sensors for torque and movement, measure the twist with a strain gauge in various driving parts like the engine and transmission.



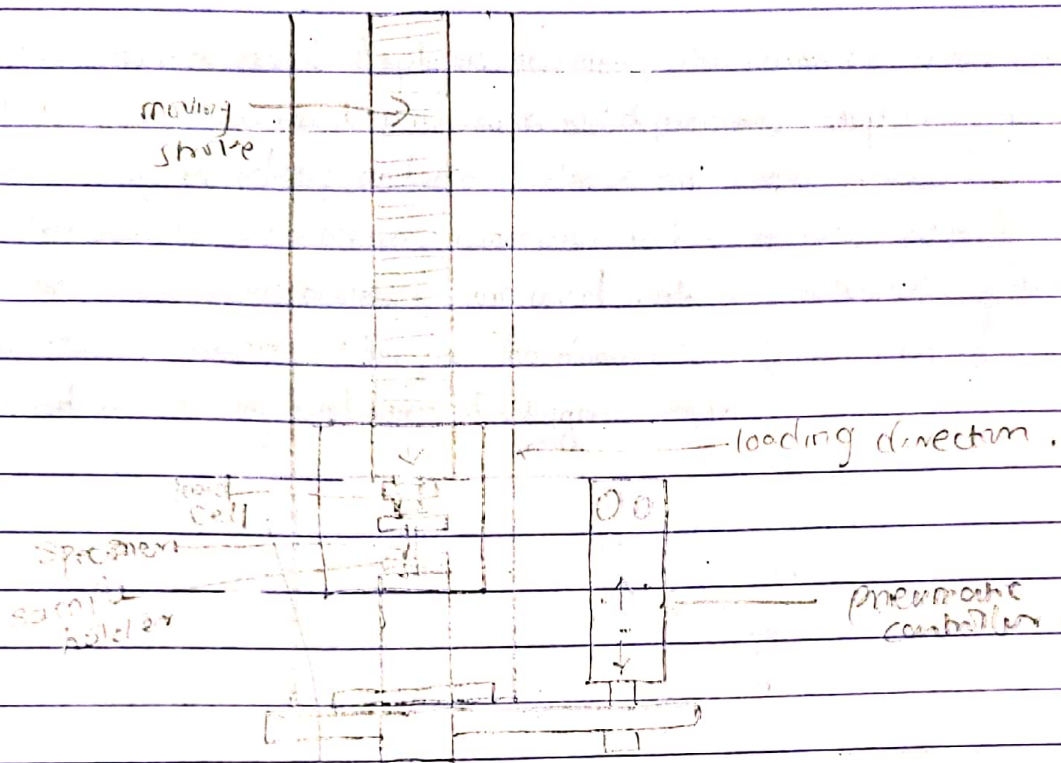
vi) Vector Sensors: A sensor that detects the translation power in two directions. This sensor can be used because of a simple structure, and is best for the usage of the gripping force detection.



vii) Digital Indicators: They are produced for use in its load cells, transducers and measuring components.

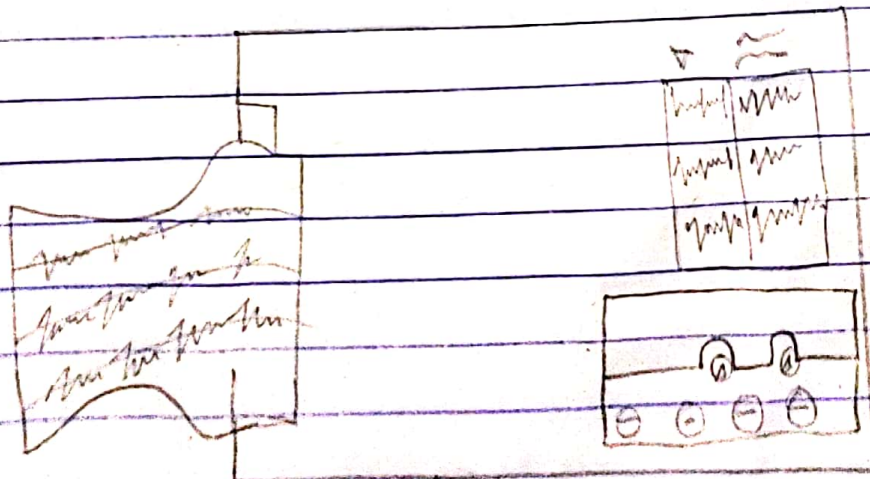


viii) Tensile and Compression Testing Machines: Used to measure the amount of stretch and contraction of devices.



### 3) CASE STUDIES OF TWO MEDICAL MEASUREMENT INSTRUMENTS (Electrocardiograph, Sphygmomanometer)

1) Electrocardiograph: This is a machine used for electrocardiography, which is the process of producing an electrocardiograph (ECG or EKG). It is a graph of voltage versus time of the electrical activity of the heart using electrodes placed on the skin. These electrodes detect the small electrical charges that are due to cardiac muscle polarity, followed by repolarization during each cardiac cycle (heart beat). Changes in normal ECG pattern are usually indicators of heart and blood flow problems, ~~etc.~~ in other words, issues with the circulatory system.





w) Sphygmomanometer: A sphygmomanometer, also known as blood pressure monitor, is a device used to measure blood pressure, composed of an inflatable cuff to collapse and then release the artery in the cuff in a controlled manner, and a mercury manometer to measure the pressure.

Manual sphygmomanometers are used with a stethoscope when using the auscultatory technique. This manual sphygmomanometer is classified into mercury and aneroid sphygmomanometer.