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Computer Engineering
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EEE 319

1 Describe briefly (with examples) sensors and Actuators for biomedical applications
2 Describe with sketches and examples of the Components of a basic measuring instrument
3 Describe briefly case studies of two medical Measurment instruments.

Answers

1 A Sensor is a device, module, Machine, or subsystem whose purpose is to detect events or changes in it's environment and send the information to other electronics, frequently a ~~Computer~~ computer processor A sensor is always used with other electronics

An actuator is a Component of a machine that is responsible for moving and controlling a mechanism or system for example by opening a valve. In simple terms, it is a 'mover'.
An actuator requires a control signal and a source of energy.

Actuators and sensors can be used in so many fields of engineering but here we looks at the applications in the field of biomedical engineering

Sensors

In biomedical sensors field, main applications of biomedical sensors areas follows Detecting the information of clinical chemistry. in the field of medicaly clinic and basic research the biology's informations needs to be detected to ensure the present state of given biology for example before operating on a patient, a doctor needs to know the body temperature and blood pressure, under this condition given Clinice thermometer and blood sensor has to be employed to help doctor quickly detect body temperature and blood pressure of patient

Class of sensors	Biomedical sensor
Physical sensors	Geometric mechanical Thermal Hydrulic

Chemical sensors	Electric optical Gas Electrochemical Photometric Other physical chemical methods
Biopotential electrodes	Body surface biopotential electrode metal plate intracellular and intratissue electrode micro electrode
Bioanalytic (for biosensors)	Enzymes, protein, Antigen, Antibody, Ligand, Cell and DNA.

Actuator

An actuator as we know is a device that converts energy into motion or applies force. The medical mechanical device takes energy in the form of hydraulics, pneumatics, or from a motor, and converts it into motion that motion can come in many forms, such as ejecting, blocking or clamping.

This actuators are used in so many fields of engineering but here we look at it's application in biomedical engineering

In biomedical engineering it's used in building machine to aid in the medical works, this machines could be known as robots.

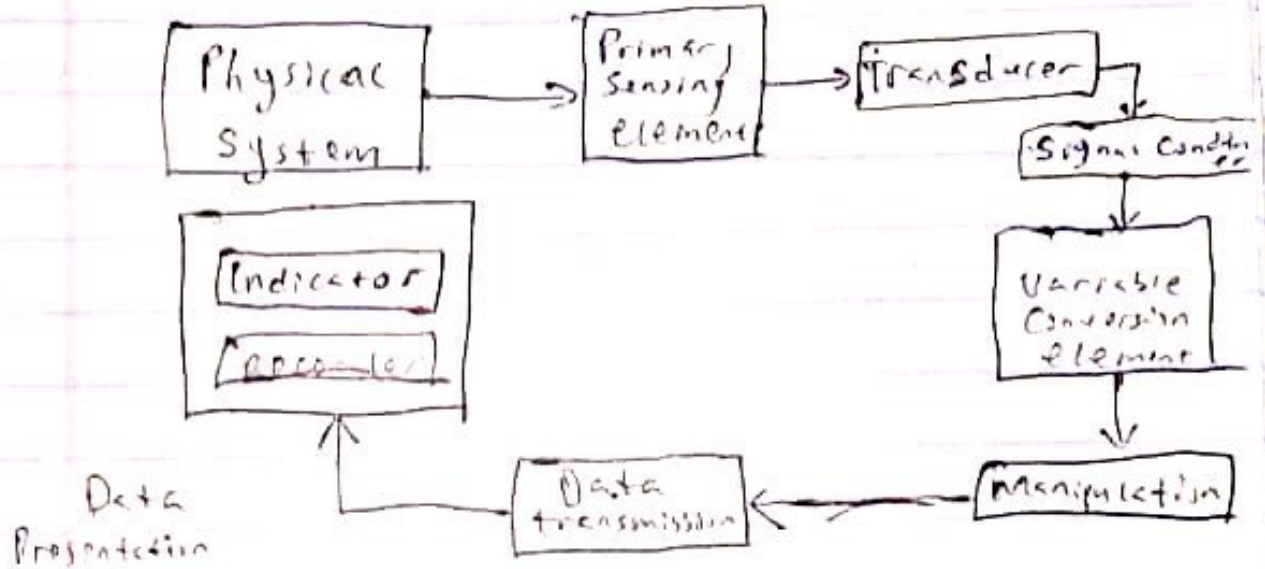
The different categories are

i. Pneumatic-muscles
ii. Active lower limb orthosis
iii. Surgical grasper
iv. The ~~finger~~ finger of a robotic hands

This are parts that make up flexible actuat in biomedical engineering.

2 Measurment system and its elements

A measurment system may be defined as a systematic arrangement for the measurment or determination of an Unknown quantity and analysis instrumentation. The generalised measurment system and it's different Components/elements are



The operation of a system can be explained in terms of functional elements of the system.

1. Primary Sensing elements

It is an element that is sensitive to the measured variable. The physical quantity under measurment of a measurment system. The measurand is always disturbed by the act

of the measurement, but good instruments are designed to minimise effect this effect.

ii Variable Conversion elements

After passing through the primary sensing element, the output is in the form of an electrical signal, may be voltage, current, frequency which may not be accepted to the system.

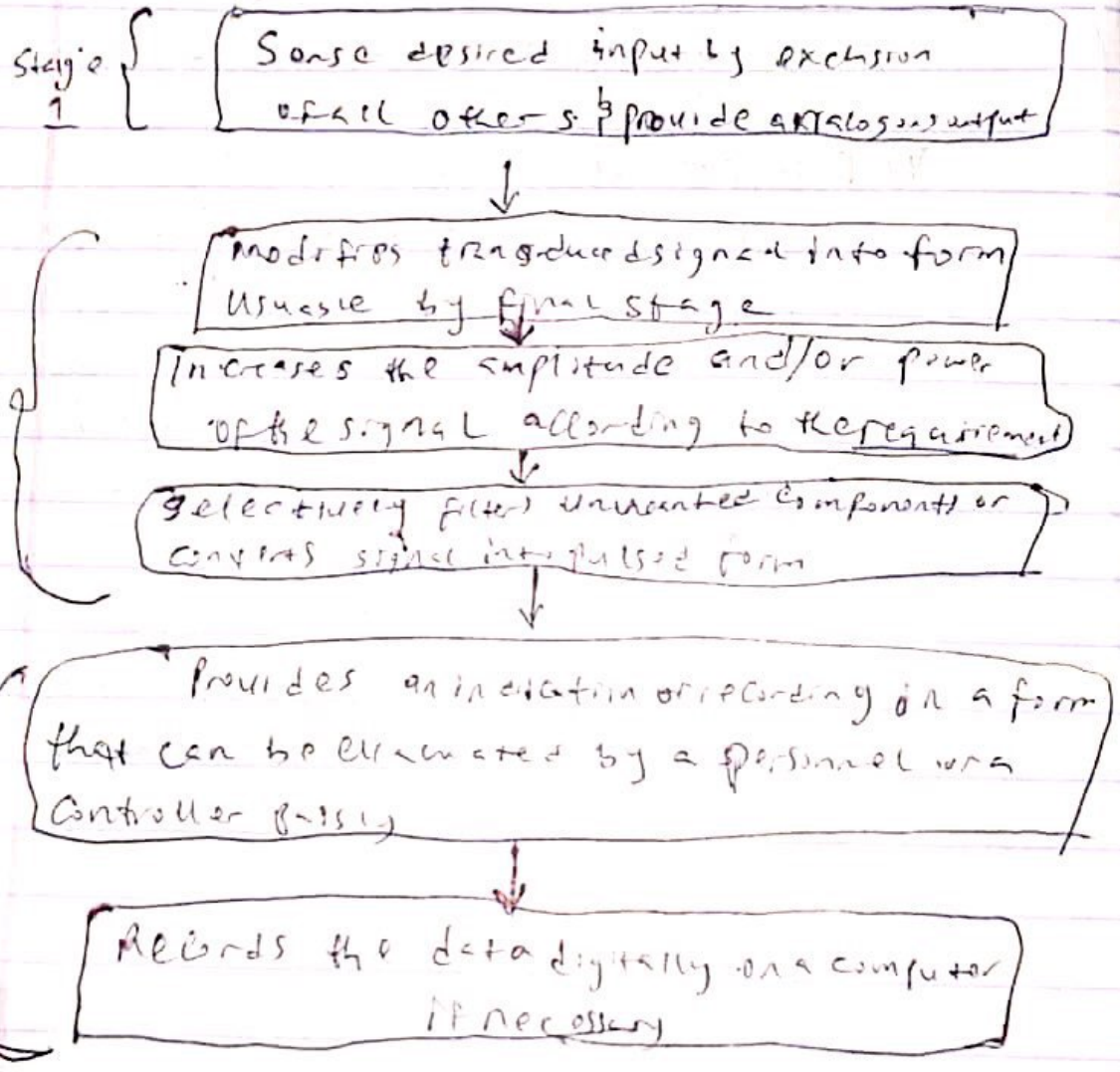
iii Manipulation elements

Some times it is necessary to change the signal level without changing the information contained in it for the acceptance of the instrument. The function of the variable manipulation unit is to manipulate the signal presented to it while preserving the original nature of the signal. For example an electronic amplifier. Converts a small low voltage input signal into a high ~~low~~ voltage output signal

iv Data transmission element

The data transmission element are required to

The stage of a typical measurement system are summarised below with the help of a flow diagram



3 Ultra sensitive temperature sensors

The world's leading manufacturing companies from IT to aerospace, need ever smaller, more precise parts. A barrier to such innovation is that at this level of precision process control instrumentation can be effected by small variations in temperature effecting the specification of end-products. By measuring ambient temperature with ultra-sensitive thermometers, manufacturers will be able to identify linear & other machine inaccuracies and temperature fluctuations and develop compensation methods to offset them

4 Nano scale surface mapping

Manufacturers of nano materials such as those used in semiconductors and solar cells need accurate tools for quality control. Knowing precisely where on a sample's surface measurements are being made and having confidence to the result achieved are key to reliably characterise.

Characterising materials properties. Atomic force microscopy has great potential use in material science but problems associated with ~~extended~~ extended measurment run times and instrument drift need to be overcome.