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18/ENG08/025

BIOMEDICAL ENGINEERING

QUESTION

1. Describe briefly (with examples) sensors and Actuators for biomedical applications.

A sensor is a device that detects and responds to some type of input from the physical environment which are very critical components in all devices and measurement systems. They are widely used in various fields such as medicine, science, automated manufacturing etc.

Biomedical sensors take biomedical variables and usually convert them into an electrical or optical signal. As such, the biomedical sensor serves as an interface between a biological and an information system. The sensors are classified into 3 namely, Physical sensors which measures body temperature, blood pressure etc, chemical sensors which measures the ingredient and concentration of body liquid such as pH value, and Biosensor which are usually used to sense enzyme, RNA, DNA etc.

An actuator drives the events within the equipment, it drives the event within the equipment. It takes an electrical signal and combines it with energy source to create a physical motion. An electrical pulse may drive the function of a motor within an asset.

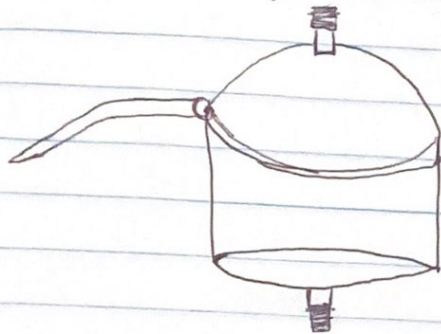
Examples of sensors and actuators used for biomedical applications include:

- a. Magnetometer
- b. Cameras
- c. Solenoid
- d. Motor Controllers
- e. Accelerometer
- f. pH meter
- g. Electrical thermometer
- h. Spring actuators
- i. Scanners

2. Describe with sketches and examples of the components of a basic measuring instrument

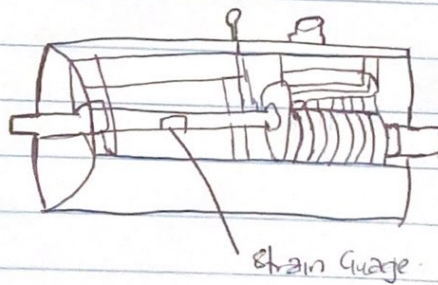
a. Load Cells

A load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally.



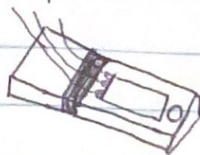
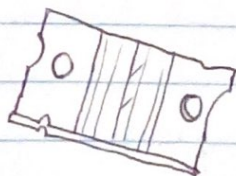
b. Torque Transducer

A torque sensor is a transducer that converts a torsional mechanical input into an electrical output signal. A reaction torque sensor measures static torque and rotary measures dynamic torque. Rotary torque transducers are used in applications where the torque transducer must rotate when attached to a spinning shaft.



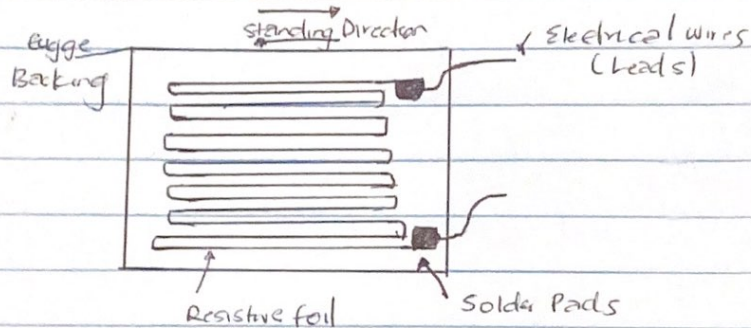
c. Force Sensors

The force sensors are sensors for mass production that use strain gauges



d Strain gauge

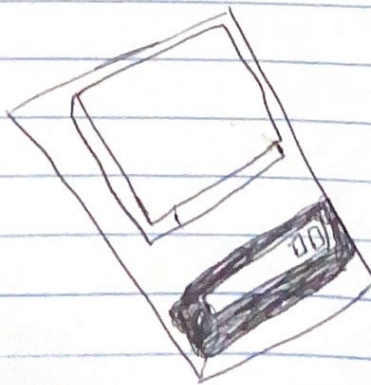
A strain gauge is a sensor whose resistance varies with applied force. It converts force, pressure, tension, weight etc into a change in electrical resistance which can be measured. When external forces are applied to a stationary object, stress and strain are the result.



3. Describe briefly case studies of two medical measurement instruments.

2. Weighing Scale:

A weighing scale is a device used to measure weight or mass. These are also known as mass scales, weight scales, mass balances, weight balances, or simply scales, balances or balance scales. The traditional scale consists of two plates or bowls suspended at equal distances from a fulcrum. One plate holds an object of unknown mass (weight), while known masses are added to the other plate until static equilibrium is achieved and the plates level off. Electronic digital scales as which we are using a being used often, display weight as a number usually on a Liquid Crystal display. They are versatile because they may perform calculations on the measurement and transmit it to other digital devices.



b. Bedpan

A bedpan or bed pan is a receptacle used for the toileting of a bedridden patient in a health care facility, and is usually made of metal, glass, ceramic or plastic. A bedpan can be used for both urinary and fecal discharge.

A 50 years old woman was admitted to a hospital with an admittance of partial stroke and a right heel ulcer. During the admission the patient was weak and could not make use of her right side of her body and was primarily bedridden so she had to use a bedpan for toileting.

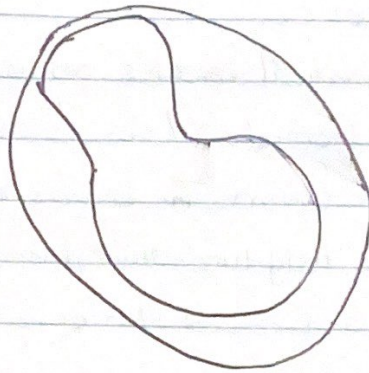


Illustration of a bedpan.