Olugde Oluwatobi Vincent
18/ENG02/081
Computer Engineering 300lv
Measurement and Instrumentation Assignment
EEE 319

1 Describe briefly Sensors and Actuators for Biomedical Engineering

In the twentieth Century, technical and technological innovation has progressed at such an accelerated pace that it has permeated almost every field of our life. This is especially true in the field of medicine. With almost Continual technological innovation during medical Care, engineering professionals have become intimately involved in many medical Ventures. As a result, the discipline of biomedical engineering has emerged as an integrating medium for diverse professions.

One of the most important parts of biomedical Engineering is that of biomedical Sensors which enable the detection of biologic events and their Conversion to signals. Sensors Convert one type of quantity such as temperature into an equivalent signal of another type of quantity, for example, an electrical or Optical signal. Biomedical Sensors take biomedical Variables and usually Converts them into an electrical or Optical signal. As such, the biomedical Sensor Serves as an interface between a biological and an information System

Some of the applications of Sensors in the field of Biomedical engineering are

- Sensors have enabled us to develop Computer based

medical imaging tools that could not be available without them

- Sensors may also bring a great development in Conventional Imaging tools, like X-ray, photography by getting more information with smaller radiation doses
- Rapid diagnostic tool have emerged recently based on immunosensors and DNA-chips
- Sensors based function System can replace the function of human Sensing Organs like artificial retina, hearing aids, tactile Sensing in artificial limbs etc

Examples

- Oxygen and Carbon dioxide Sensor for blood
- Heart Sound Sensor
- blood flow Sensor
- Respiration Sensor
- Blood pressure Sensor
- Electrochemical Electrode.

Actuators

In biomedical engineering field when performing Surgery on very small parts of the human body, the Doctor would in the past have followed a habituated process of which the accuracy of the results could be very low. periodic advancement in technology has meant the accuracy of these method have improved with the help of actuators. Different types of actuators are used according to the requirment and type of actuation needed. The Smart actuators are fabricated with the help of MEMS (micro

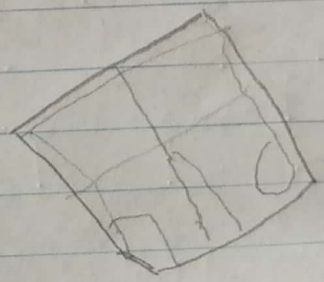
Electrical mechanical System] which is a technology that would seem to be propitious for the ~~for~~ future of biomedical field.

The application for smart actuators in biomedical engineering have become more advanced such as drug delivery using a controlled micropump with which the required drug will be supplied at specific times. Micro grippers that are actuated are used to help remove tumors. Piezo electrical actuators are used to drive a motor for drilling a hole or making a cut in surgery. They can also be used in detection, analysis, diagnosis, drug delivery and Cell Structure

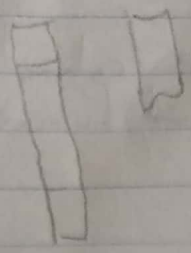
Examples
micropump
micro grippers
piezo electrical actuator

2 Components of a basic measuring System

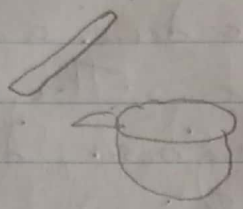
Strain guage - This Consists of a fine metallic foil etched in a grid pattern, which is bonded to a device and used to measure the strain or amount of deformation of the device



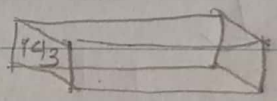
2 Force Sensors: The force sensors are sensors for mass production that use strain gages



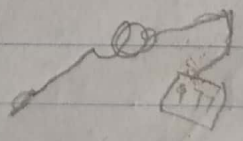
3 Load Cells
Minebea manufactures load cells that use Strain gages to Convert weight. Int electrical Output



4 Digital Indicators : This is used in load cells, transducers and other measuring components



5 pressure Sensors :. Using Strain gage, thes pressure Sensors that measure pressure as electric Signal.



Case Studies of two medical measuring instrument

1 Stadiometer

This is a piece of medical equipment used for measuring human height. It is usually constructed out of ruler and a sliding horizontal head piece which is adjusted to rest on top of the head. Stadiometers are used in routine medical examination and also clinical test and experiments.

Devices with similar concept, although with higher resolutions are used in industrial metrology applications where they are called height gauges. There is also the Digital Stadiometer.

11 Sphygmomanometer

This is also known as a blood pressure monitor, or blood pressure gauge, it is a device used to measure blood pressure, composed of an inflatable cuff to collapse and then release the artery under the cuff in a controlled manner and a mercury or aneroid manometer to measure pressure. Manual Eg Sphygomanometers are used with a Stethoscope when using the auscultatory technique.

A Sphygmometer consists of an inflatable cuff, a measuring unit (the mercury manometer or aneroid gauge) and a mechanism for inflation which may be a manually operated bulb and valve or a pump operated electrically.

There are two types of Sphygmomanometer which are the manual and Digital

The manual meters are best used by trained practitioners and while it is possible to obtain a basic reading through palpation alone, this yields only the systolic pressure

Digital meter employs oscillometric measurement and electronic calculations rather than auscultation. They may use manual or automatic inflation, but both types are electric, easy to operate without training and can be used in noisy environment. They measure systolic and diastolic pressure by oscillometric detection, employing either deformable membranes that are measured using differential capacitance or differential piezoresistive and they include a microprocessor.

The Sphygmomanometer was invented by Samuel Siegfried Karl Ritter Von Basch in the year 1881