



جامعة المستقبل  
AL MUSTAQBAL UNIVERSITY

# Al-Mustaqbal University

## College of Science



University of  
Information Technology  
and Communications

## Intelligent Medical System Department

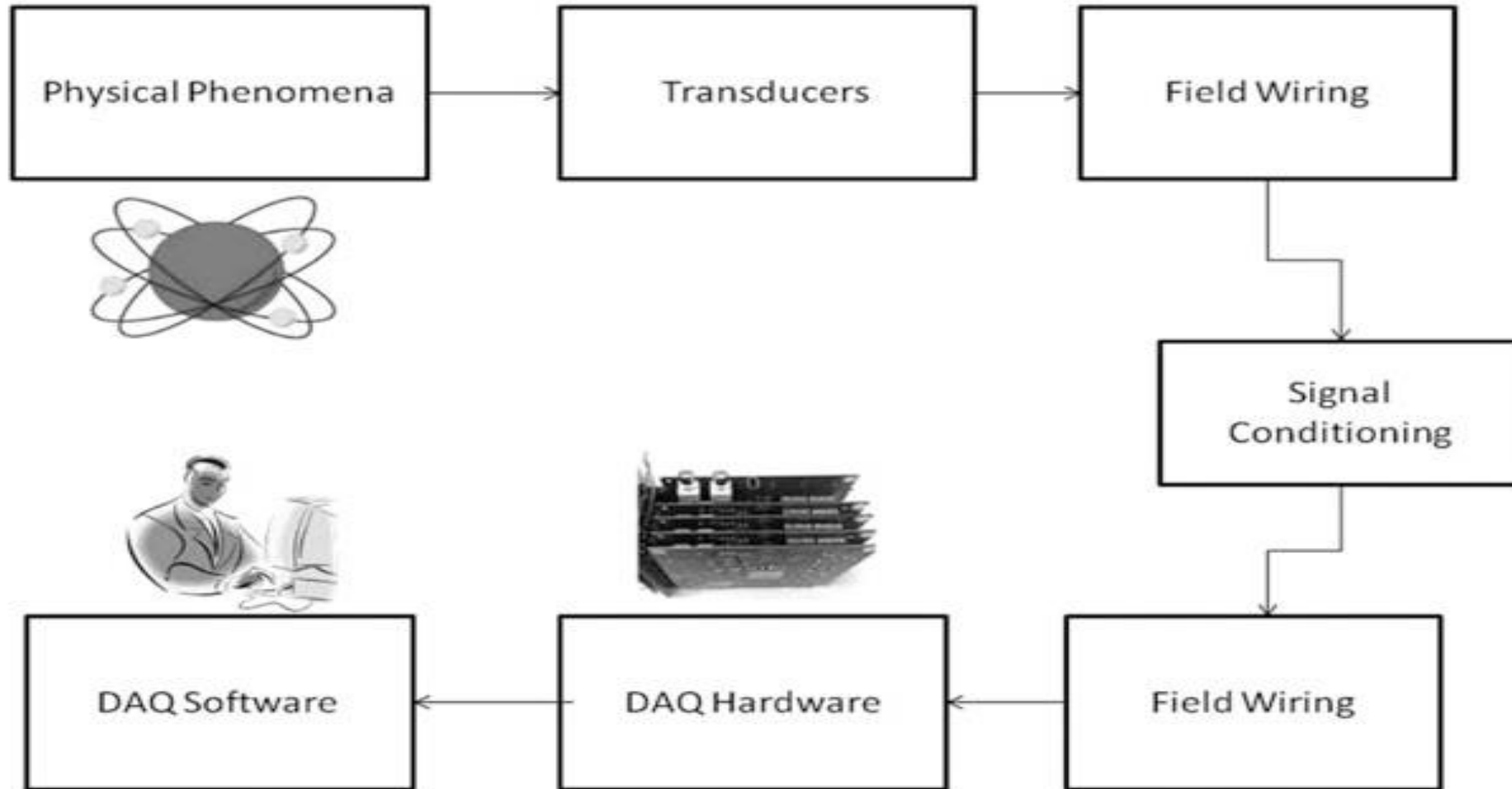
قسم الانظمة الطبية  
الذكائية

**Lecture 1- Data Acquisition system**  
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# INTRODUCTION

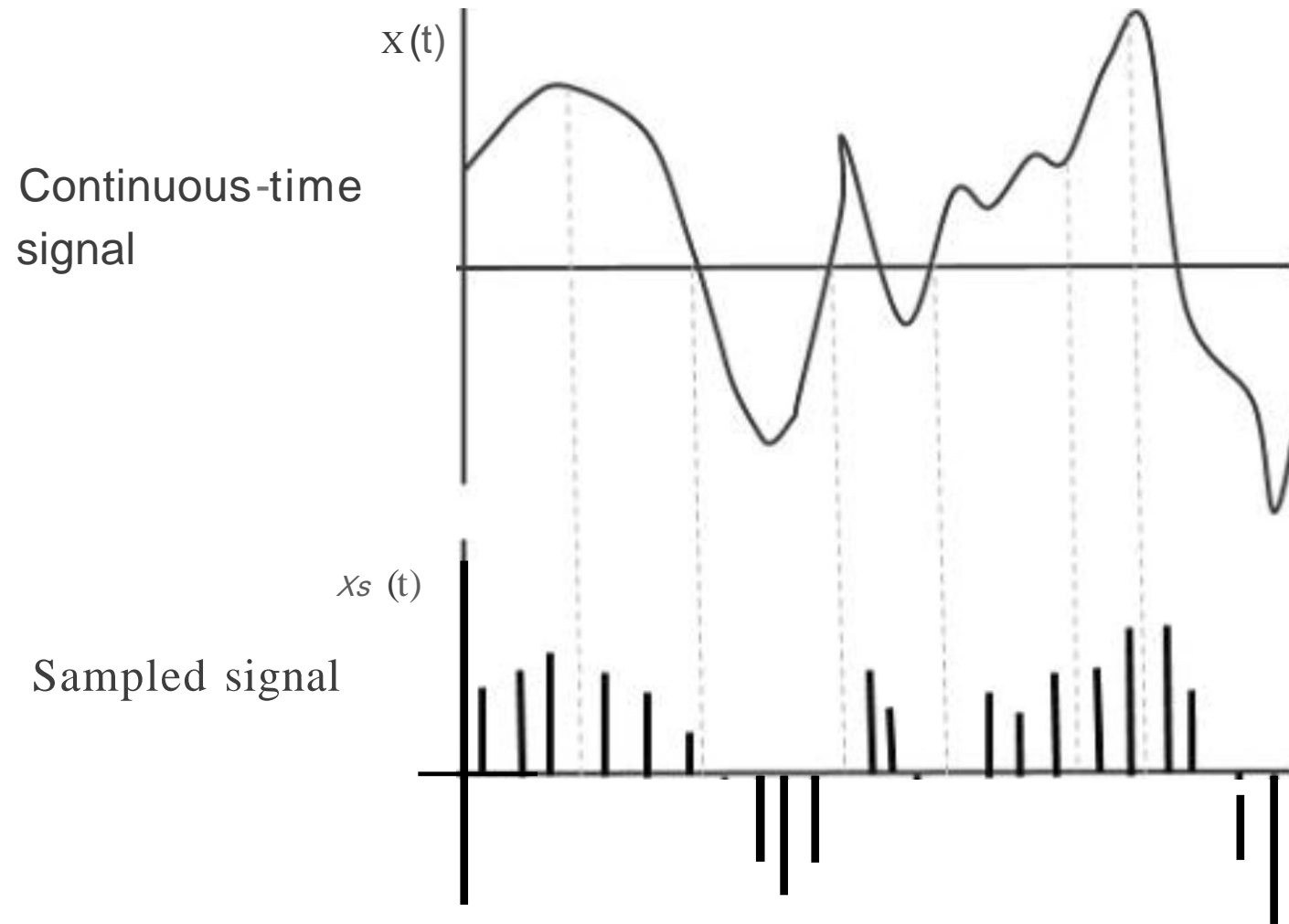
- **DATA ACQUISITION** (DAQ) systems are the main instruments used in laboratory research from scientists and engineers;
- Typically, DAQ systems are general-purpose DAQ instruments that are well suited for measuring voltage or current signals. However, many sensors and transducers output signals must be conditioned before that a board can acquire and transform in digital the signal.
- The basic elements of DAQ are shown in Fig. 1 and are:
  - Sensors and transducers
  - Field wiring
  - Signal conditioning
  - DAQ hardware
  - DAQ software
  - PC (with operating system)

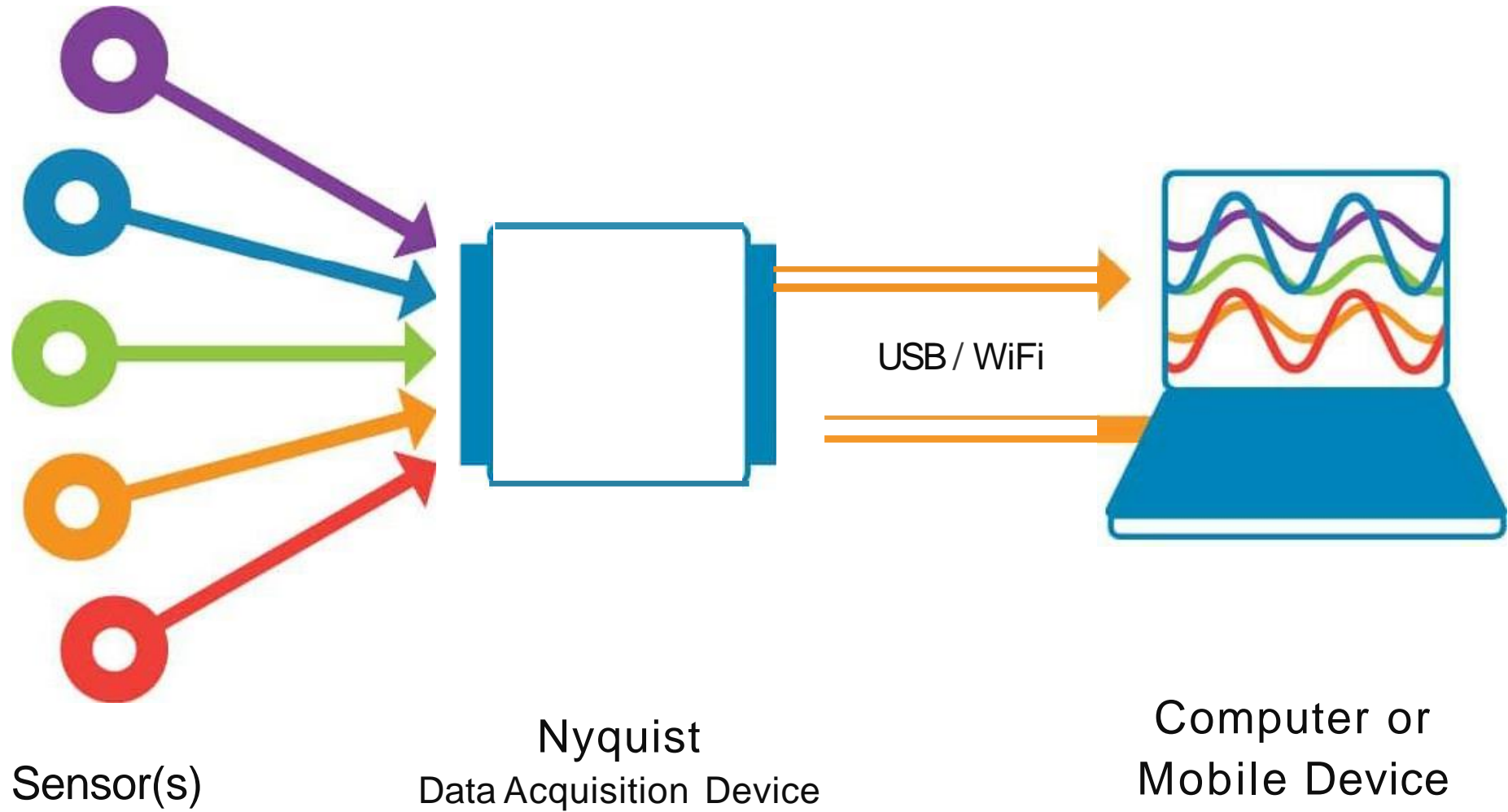
# INTRODUCTION



# INTRODUCTION

- Also, DATA ACQUISITION is the process of sampling signals that measure real world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer.
- Data acquisition systems (abbreviated with the acronym DAS or DAQ) typically convert analog waveforms into digital values for easy processing.





# INTRODUCTION

The components of data acquisition systems include:

- Sensors that convert physical parameters to electrical signals.
- Signal conditioning circuitry to convert sensor signals into a form that can be converted to digital values.
- Analog-to-digital converters, which convert conditioned sensor signals to digital values.

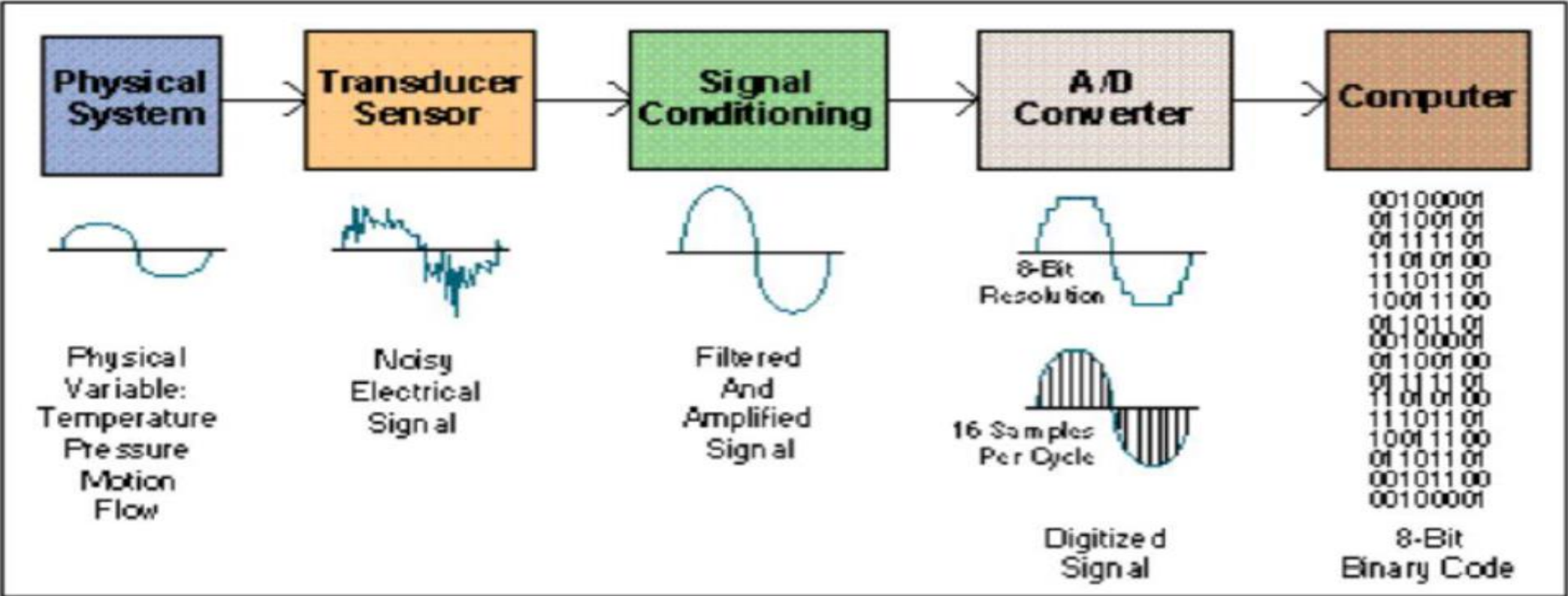
# OBJECTIVE

- DAS must acquire the necessary data, at correct speed and at correct time.
- It must monitor the complete plant operation to maintain on line and safe operations.
- It must be able to collect, summarise and store data for diagnosis of operation and record purpose.
- It must be flexible and capable of being expanded for future requirements.
- It must be able to compute unit performance indices using on-line, real time data.
- It must be reliable, easy to operate and must be user friendly.



# BLOCK DIAGRAM

# DAS BLOCK DIAGRAM

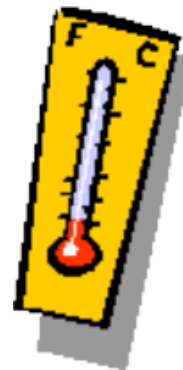




# PHYSICAL SYSTEM/CONDITIONS

Physical condition that can be used as input of DAS or which can be represented in Digital form are as under ...

- Temperature
- Pressure
- Light
- Force



- Displacement
- Level
- Electric signals
- ON/OFF switch

Transducer  
Sensor

# TRANSDUCERS

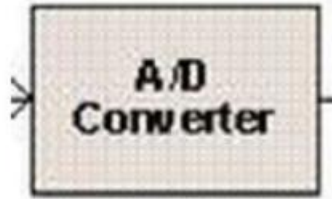
- A transducer converts temperature, pressure, level, length, position, etc. into voltage, current, frequency, pulses or other signals.
- A transducer thus converts the physical conditions in electrical waveform for easy signal processing



# SIGNAL CONDITIONING

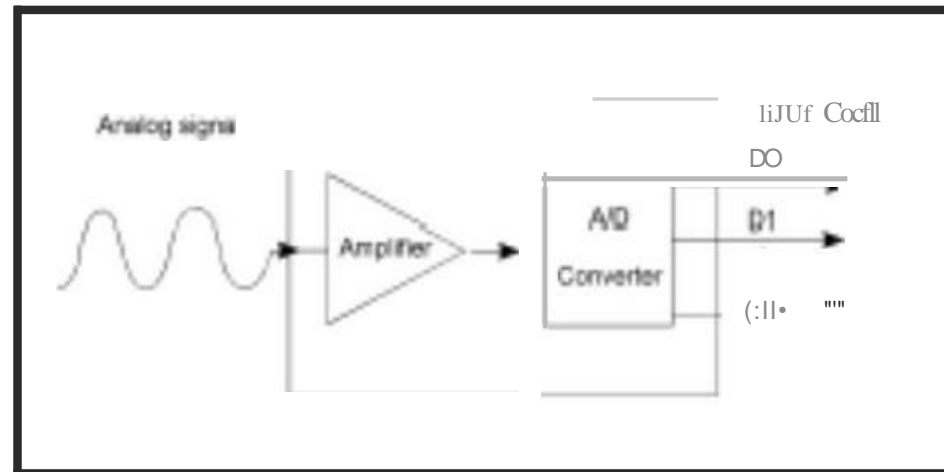
- Signal conditioning circuits improve the quality of signals generated by transducers before they are converted into digital signals by the PC's data acquisition hardware.

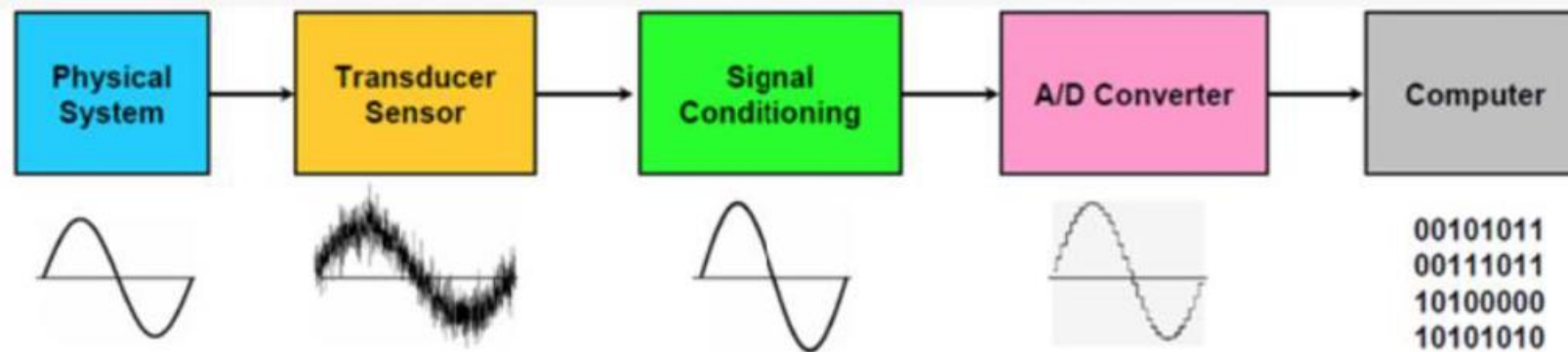
Most common signal conditioning functions are amplification, linearization, cold-junction compensation, filtering, attenuation, excitation, common-mode rejection, and so on.



## ANALOG DIGITAL(A/D) CONVERTER

- Analog to digital (A/ D) conversion changes analog voltage or current levels into digital information. The conversion is necessary to enable the computer to process or store the signals.







# METHODOLOGY



# METHODOLOGY

- DAS begins with the physical property to be measured. Examples of this include temperature, light intensity, gas pressure, fluid flow, force etc.
- A sensor, which is a type of transducer converts a physical property into a corresponding electrical signal
- Signal conditioning may be necessary if the signal from the transducer is not suitable for the DAQ hardware being used.
- After signal conditioning the analog wave output is converted into digital form using *A/D* converter.
- Once digitized, the signal can be encoded to reduce and correct transmission errors.
- This whole process is called as DATA ACQUISITION SYSTEM



# EXAMPLES OF SENSORS

# TRANSDUCERS/SENSORS

Quantity being measured	Input device (sensor)	Output device (actuator)
Light level	Photodiode photo-transistor solar cell	Lamps–LED–fibre optics
Temperature	Thermistor–thermocouple	Heater–fan
Force/pressure	Pressure switch	Electromagnetic vibration
Position	Potentiometer–encoder	Motor
Speed	Tacho-generator	AC/DC motors
Sound	Carbon microphone	Buzzer–loudspeaker

# CONCLUSION

- D** Data acquisition systems typically convert analog Physical condition into digital values for easy processing.
- D** DAS is advantageous as we can store a lot of physical condition data in digitized form
- D** DAS helps in easy processing of data as well as easy comparison can be done.
- D** Today DAS is used in almost every field, industry and companies.