Introduction to Robotics

Manipulation and Programming

Unit 3: Sensors and Vision

OVERVIEW

DR. ERIC CHOU

IEEE SENIOR MEMBER

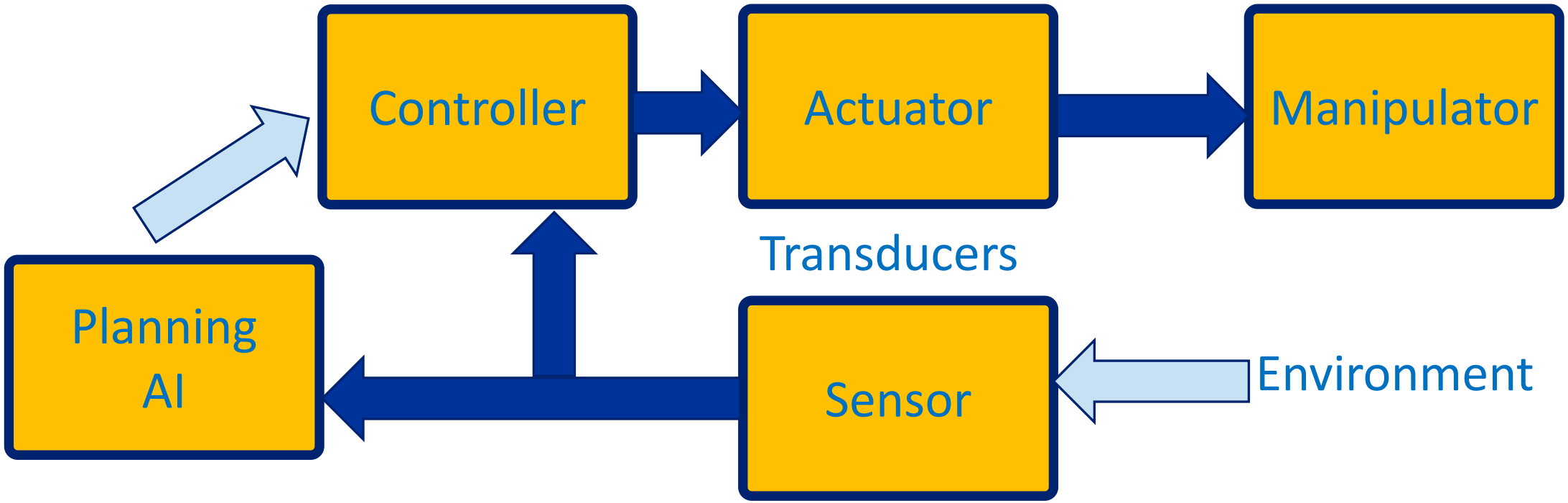
Unit 3

- Overview
- Digital Sensors
- Analog Sensors
- Camera and Color
- Image Subtraction and Object Localization
- Camera Coordinates

Overview

SECTION 1

Logical Units for A Robot



Sensors

SECTION 1

Sensor

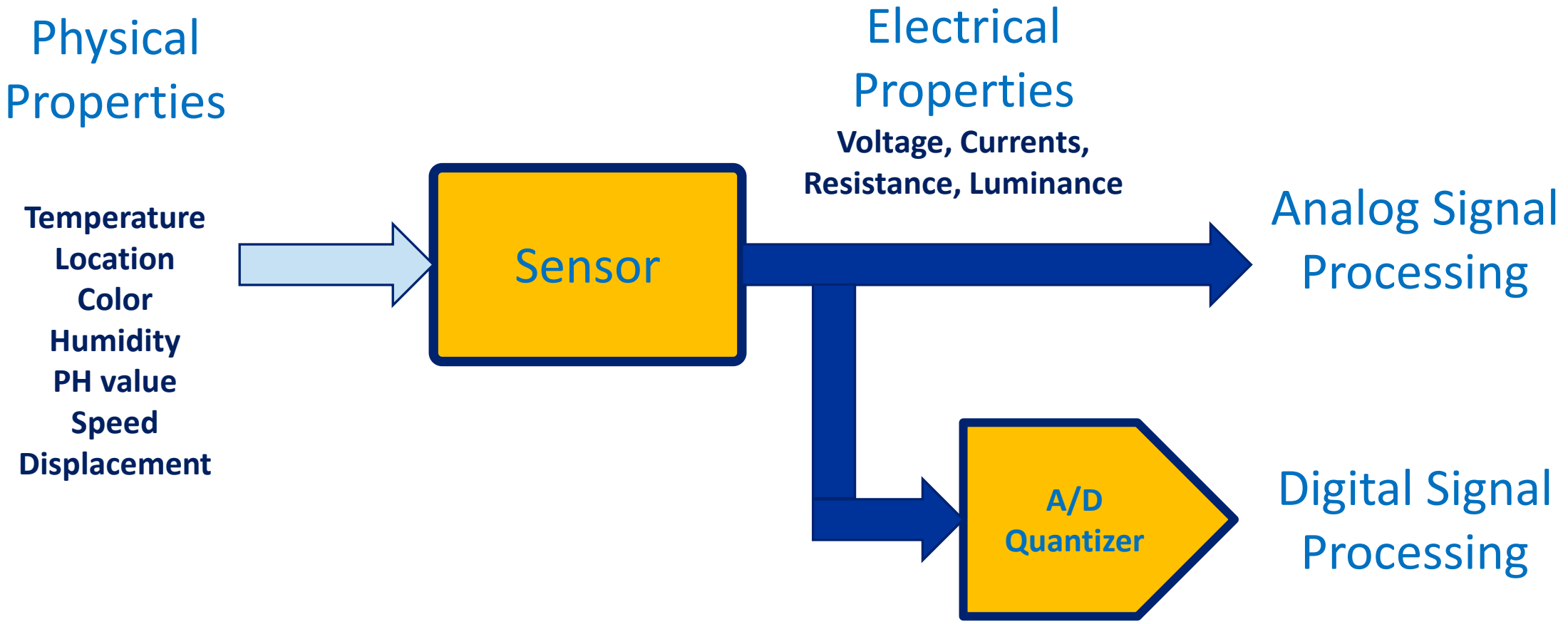
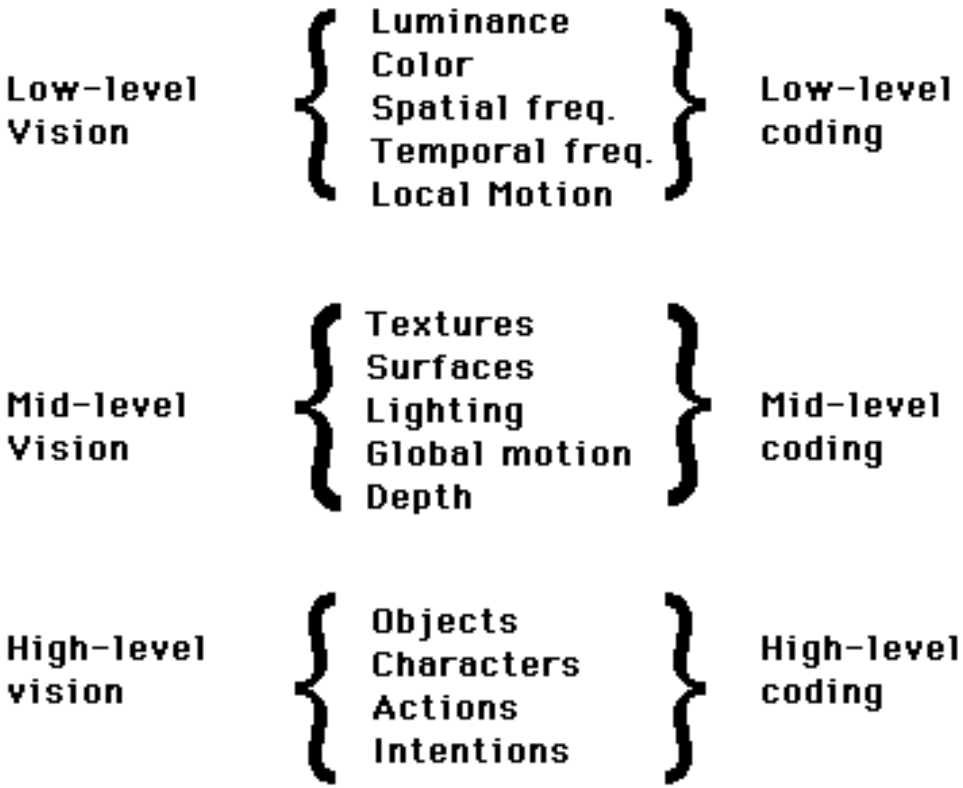
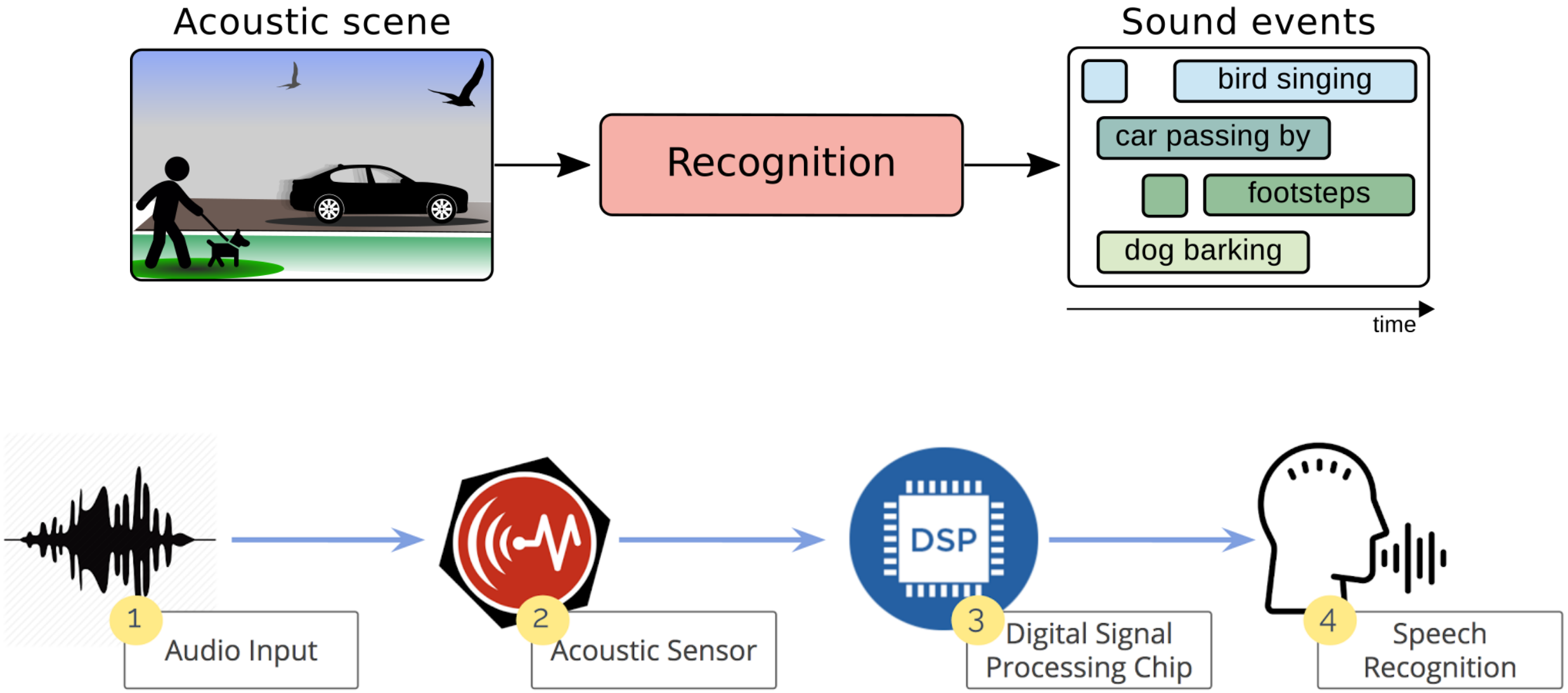

Physical Properties
Temperature
Location
Color
Humidity
PH value
Speed
Displacement
Sensor
Electrical Properties
Voltage, Currents,
Resistance, Luminance
Analog Signal Processing
A/D Quantizer
Digital Signal Processing

Image Processing

Type	Input	Output	Examples
Low Level Process	Image	Image	Noise removal, image sharpening
Mid-Level Process	Image	Attributes	Object recognition, Segmentation
High Level Process	Attributes	Understanding	Scene understanding, autonomous navigation

Image Vision




Acoustic scene
Recognition
Sound events
bird singing
car passing by
footsteps
dog barking
time
1
Audio Input
2
Acoustic Sensor
DSP
3
Digital Signal Processing Chip
4
Speech Recognition

Voice recognition

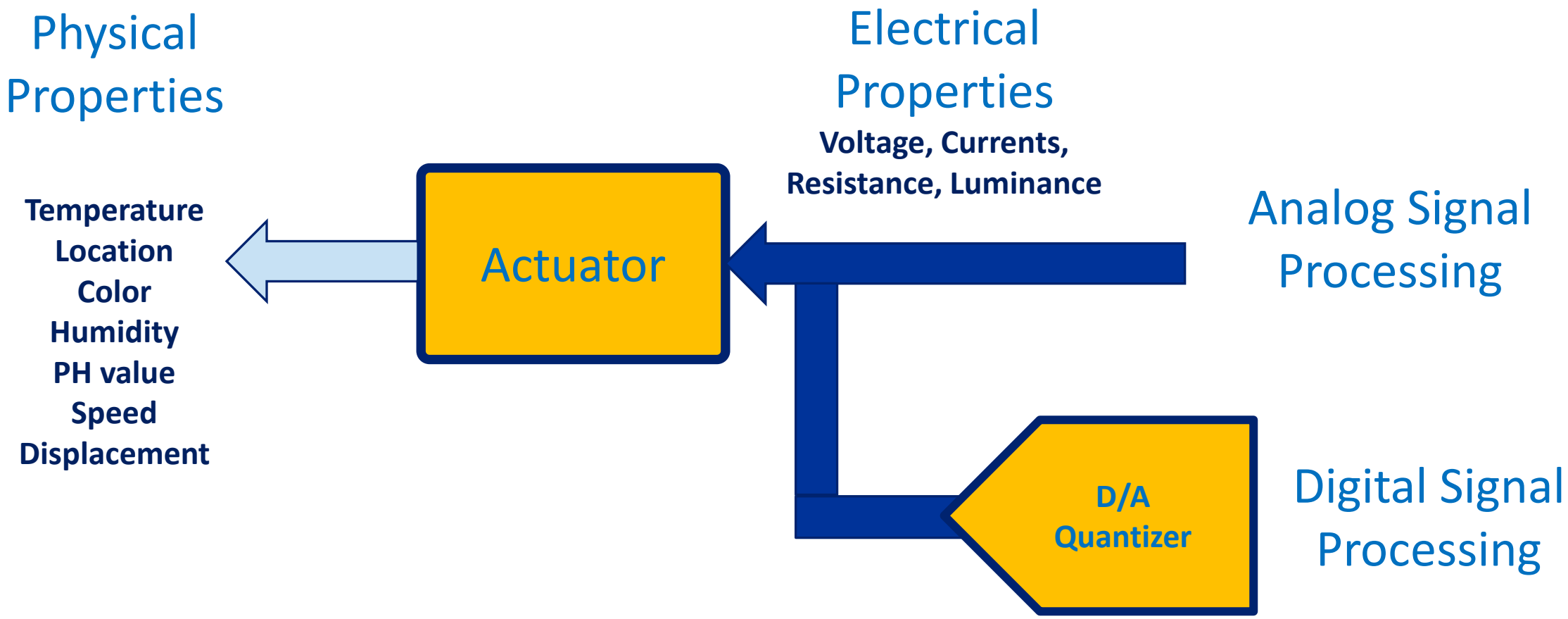
Purpose of Sensors

- To give robot information about itself. (Joint angle, connection status)
- To give robot information about the environment.

Actuators

SECTION 3

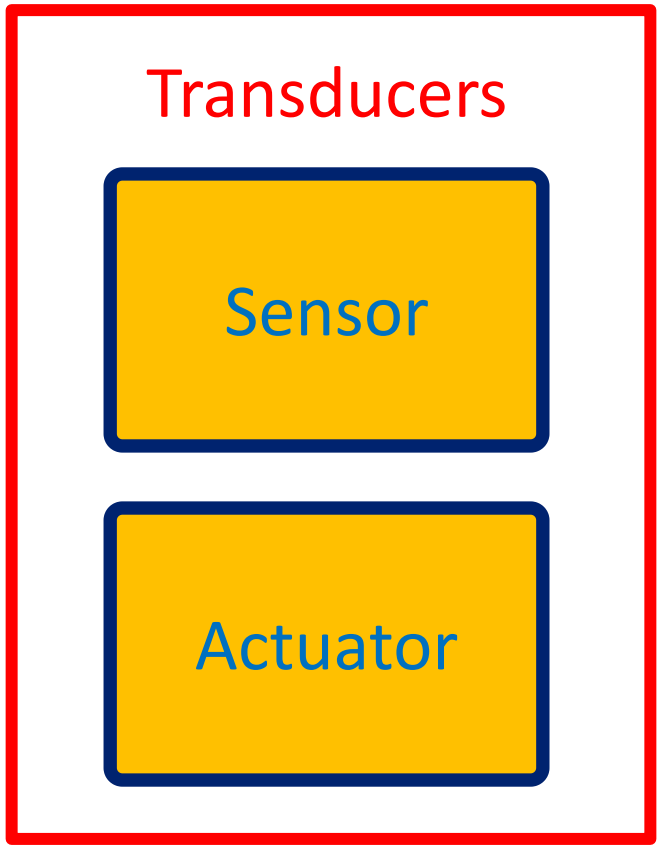
Actuators


Physical Properties
Temperature
Location
Color
Humidity
PH value
Speed
Displacement
Actuator
Electrical Properties
Voltage, Currents, Resistance, Luminance
Analog Signal Processing
D/A Quantizer
Digital Signal Processing

Transducers

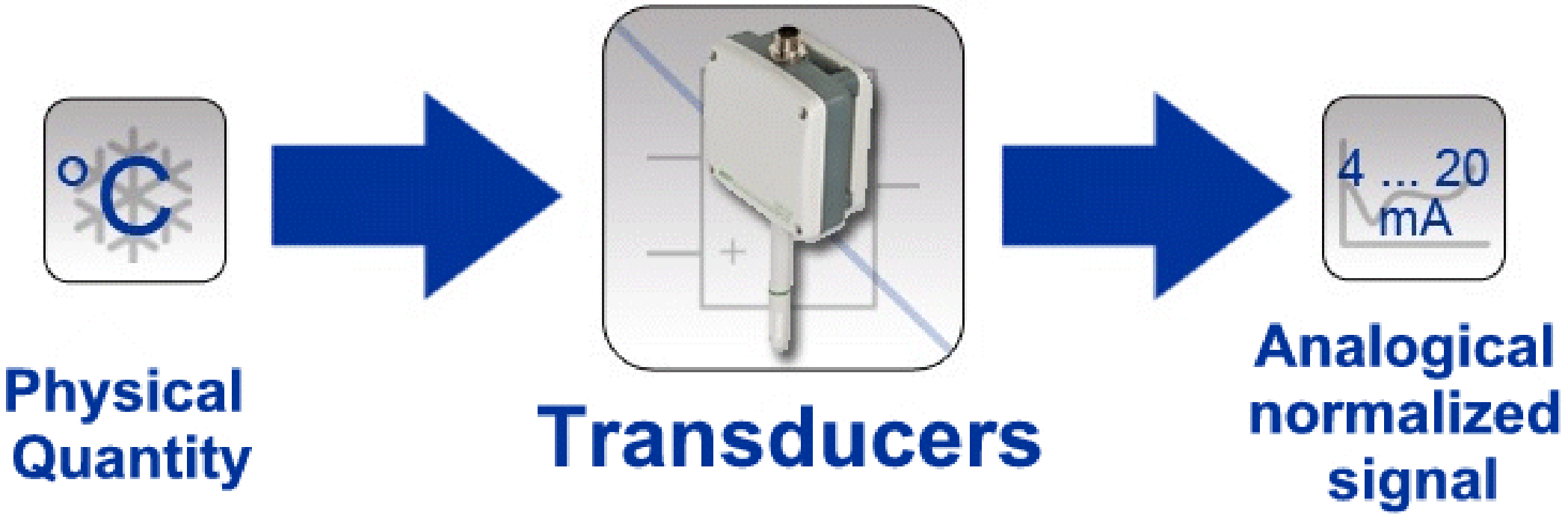
Physical Properties

Temperature
Location
Color
Humidity
PH value
Speed
Displacement

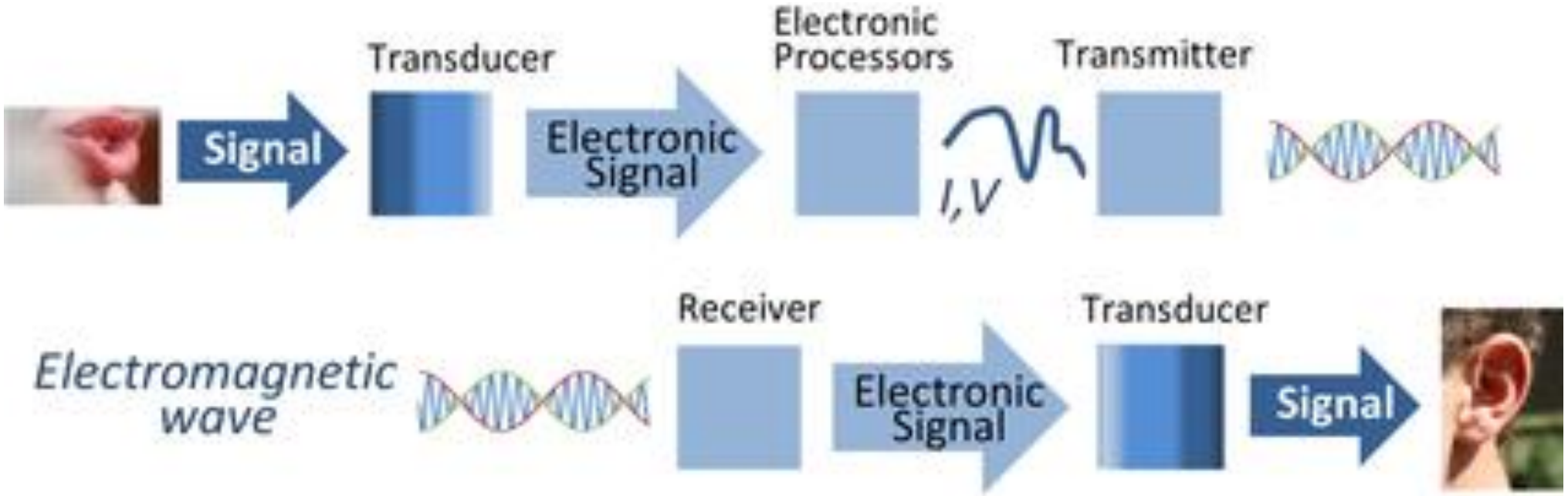


Electrical Properties

Voltage, Currents, Resistance, Luminance



Transducers


Transducer
Electronic Processors
Transmitter
Signal
Electronic Signal
I,V
Receiver
Transducer
Electromagnetic wave
Electronic Signal
Signal

End Effectors

- In robotics, an end effectors are the device or tool that's connected to the end of a robot arm end enables the robot arm to perform specific task
- Usually end effectors are custom engineered for a particular task

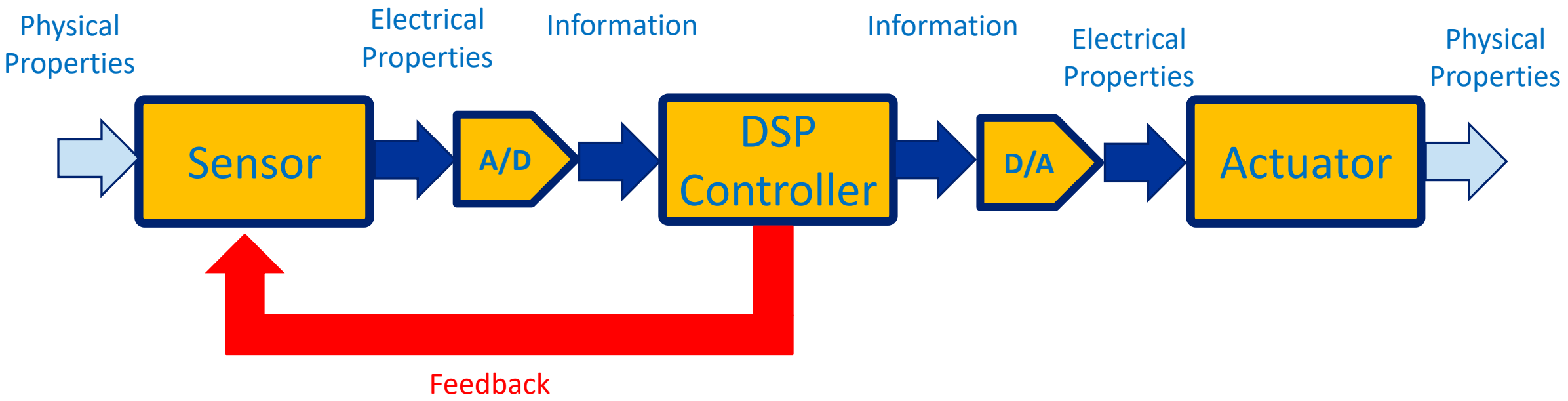



End-to-End Model

SECTION 4

End-to-End Robot Model

End-to-End DSP Robot Model



End-to-End Smart Robot Model