Part II AUTOMATION

Textbook: Groover M. P.(2008). *Automation, production systems, and computer integrated manufacturing, 3rd ed. Prentice Hall.*

- Chapter 4: Introduction to Automation
- Chapter 5: Sensors, Actuators, and Other Control System Components
- Chapter 9: Discrete Control Using Programmable Logic Controllers and Personal Computers

CH 4 INTRODUCTION TO AUTOMATION

Automation Defined

Automation is the technology by which a process or procedure is accomplished without human assistance.

"Automation = Automatic Control"

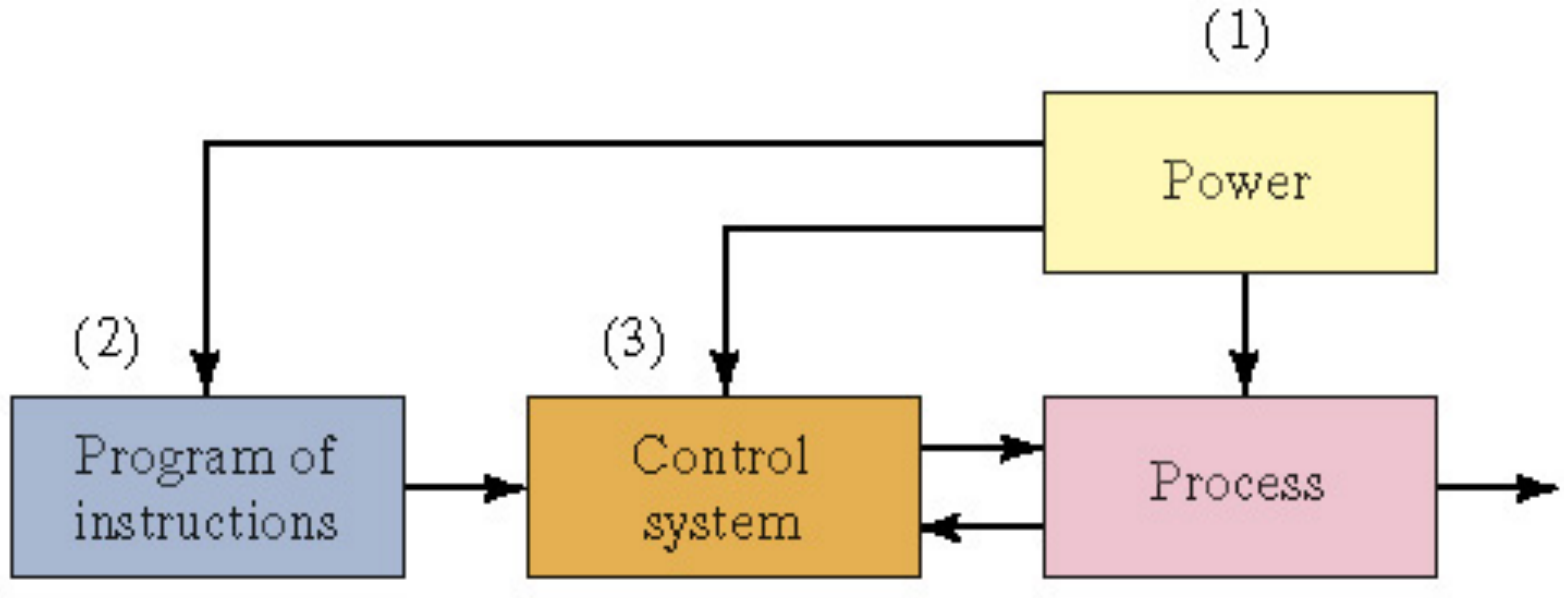
- Basic elements of an automated system:

1. *Power* - to accomplish the process and operate the automated system

2. *Program of instructions* – to direct the process

3. *Control system* – to actuate the instructions

Elements of an Automated System



1- Electricity - The Principal Power Source

- Widely available at moderate cost
- Can be readily converted to alternative forms, e.g., mechanical, thermal, light, etc.
- Low level power can be used for signal transmission, data processing, and communication
- Can be stored in long-life batteries

Power to Accomplish the Automated Process

- *Power for the process*
  - To drive the process itself
  - To load and unload the work unit
  - Transport between operations

- *Power for automation*
  - Controller unit
  - Power to actuate the control signals
  - Data acquisition and information processing

2- Program of Instructions

Set of commands that specify the sequence of steps in the work cycle and the details of each step

- Example: CNC part program
- During each step, there are one or more activities involving changes in one or more process parameters
  - Examples:
    - Temperature setting of a furnace
    - Axis position in a positioning system
    - Motor on or off

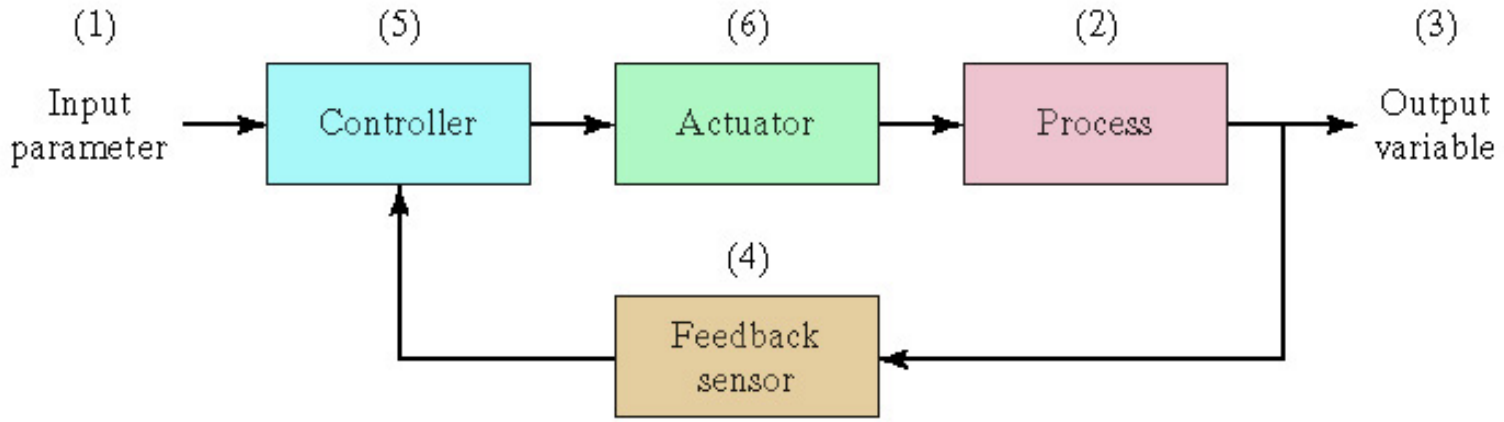
3- Control System – Two Types

1. *Closed-loop (feedback) control system* – a system in which the output variable is compared with an input parameter, and any difference between the two is used to drive the output into agreement with the input

2. *Open-loop control system* – operates without the feedback loop
   - Simpler and less expensive
   - Risk that the actuator will not have the intended effect

(a) Feedback Control System and (b) Open-Loop Control System

(a)



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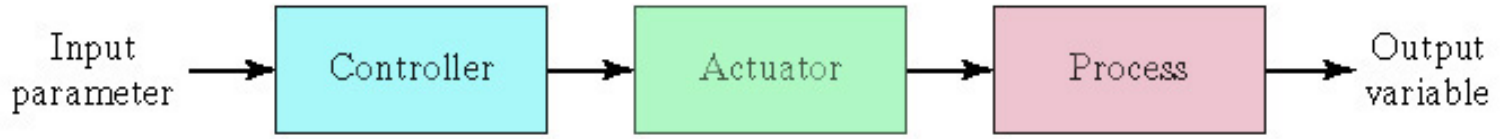
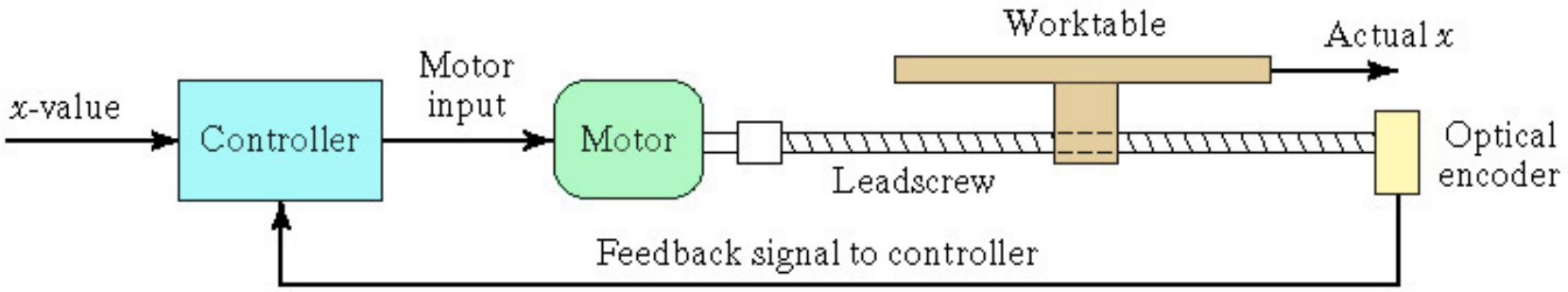


Example:

Positioning System Using Feedback Control: A one-axis position control system consisting of a lead screw driven by a DC servomotor and using an optical encoder as the feedback sensor



When to Use an Open-Loop Control System

- Actions performed by the control system are simple
- Actuating function is very reliable
- Any reaction forces opposing the actuation are small enough as to have no effect on the actuation

If these conditions do not apply, then a closed-loop control system should be used

Examples of Automation

Day to Day life

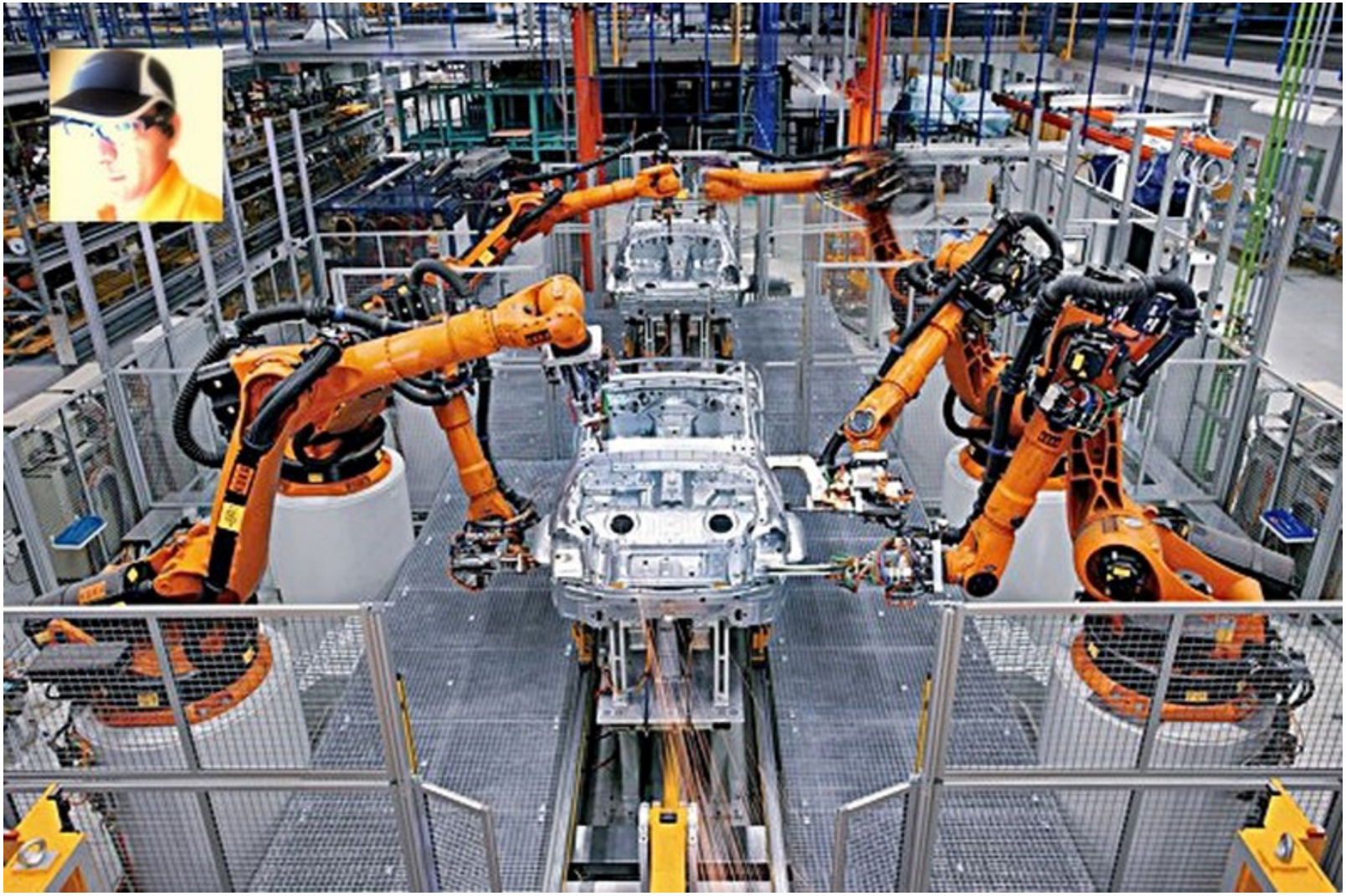
- ATM
- Vending machines
- Starting of the vehicle
- Car wipers

Industry

- Painting Robots in the automobile mfg industry
- Soldering Machines
- Automatic capping machines
- Automatic filling machines

Example: car painting

Example: cars manufacturing



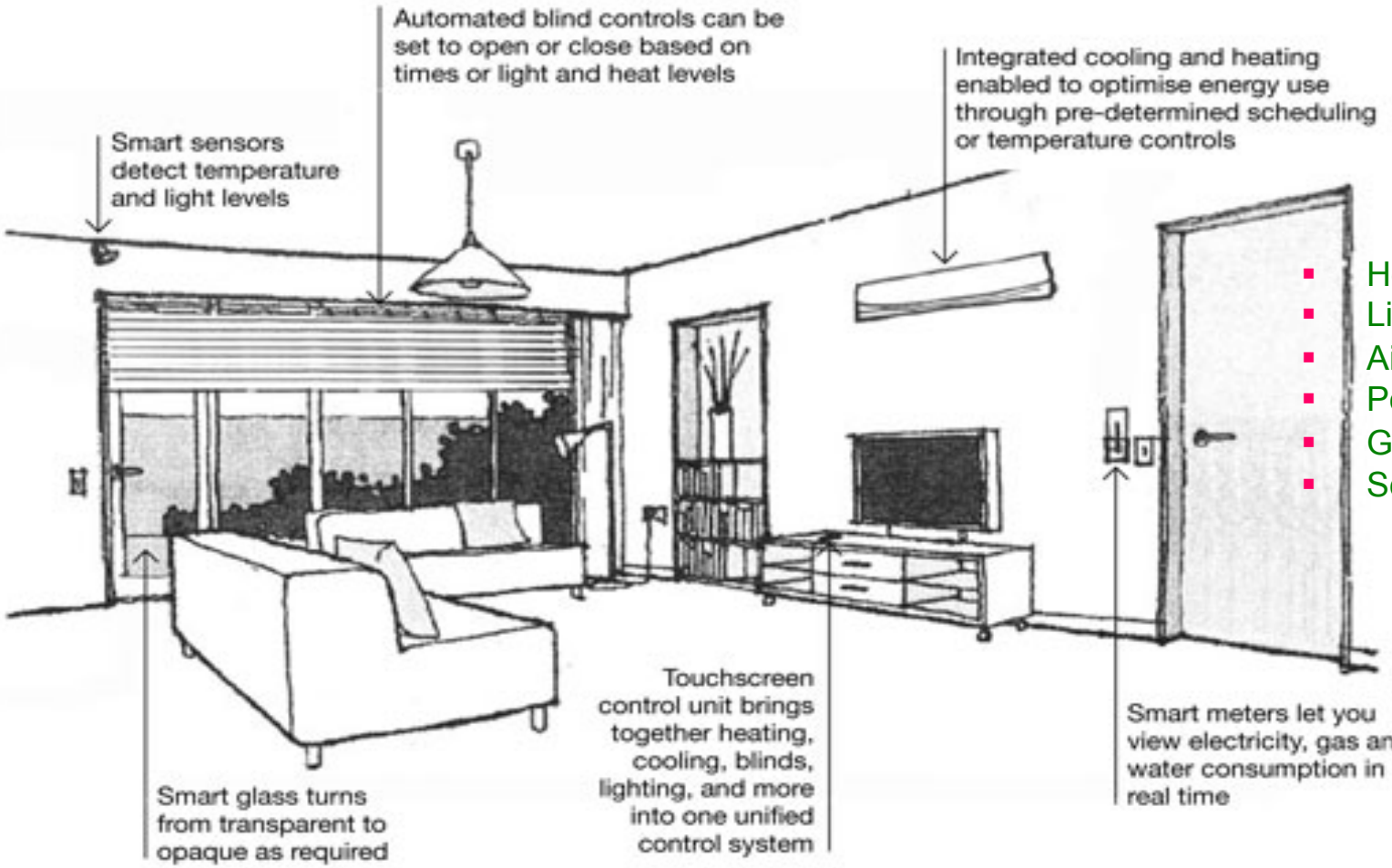
Example: soldering & brazing machine

Example: bottle filling & capping

Example: packaging

Examples of Automation

Home Automation



- Hot water systems.
- Lighting.
- Air conditioning.
- Powered window blinds.
- Garage doors.
- Security systems.

Why Automation is required ?

- Increase in comfort.
- More safety.
- Improve the quality and precision.
- To do the job for which human beings will not have the capacity.
- To avoid monotonous work.

Basic Elements of Control System

- Sensors
- Actuators
- Controllers

Chapter 5: Sensors & Actuators

Chapter 9: PLC