

Answer Key to Examples of Mechatronic Systems Activity Dr. Lufti Al-Sharif (2012)

Identifying the four components of the mechatronic systems:

1. The washing machine as an example of a mechatronic system. Let us take one of the systems within the washing machine such as the water heating system.
Plant: The water within the washing machine
Controller: Embedded controller on an integrated circuit
Actuator: Heating element
Feedback device: thermal sensing element such as a bimetallic strip or a resistance temperature detector (RTD).

2. In an anti-lock braking system, it is important to prevent the locking of the braking system when the road surface is slippery.
Plant: The wheels and the braking system
Controller: ABS control module embedded within a microcontroller
Actuator: Solenoid valve controlling the hydraulic fluid
Feedback device: Wheel speed sensors

3. Elevators: speed control system in an elevator is comprised of the following:
Plant: elevator cabin
Controller: elevator speed controller system
Actuator: induction motor, drive system
Feedback device: shaft encoder

8. Tank fluid level systems:
Plant: tank and contained fluid
Controller: microcontroller
Actuator: pump
Feedback device: float device or ultrasonic sensor

9. Temperature control system in an industrial oven:
Plant: oven and product within
Controller: microcontroller or programmable logic controller
Actuator: heating coil
Feedback device: bimetallic strip

10. Heat seeking missiles:
Plant: the missile body and any payload
Controller: microcontroller embedded within the missile
Actuator: jet engine
Feedback device: temperature sensors fitted to the body of the missile

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11. Packing Machines:

Plant: Item to be packed and conveyor carrying it.

Controller: PLC (programmable logic controller).

Actuator: Hydraulic cylinder.

Feedback device: the feedback devices for such a system are usually of three types:

- a) image processing
- b) laser range sensors
- c) ultrasonic sensors

12. Painting robot:

Plant: item to be painted (e.g. car frame)

Controller: microcontroller

Actuator: servo-motors controlling the robot parts

Feedback device: camera with image processing software

13. Coordinate measuring machine (manipulator arm):

Plant: CMM arms and object to be scanned

Controller: PC with dedicated software

Actuator: Human operator (i.e. not automated!)

Feedback device: absolute shaft encoders on the CMM