# Centralized Control Systems

## Definitions

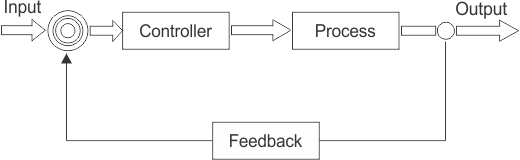
|  |  |
| --- | --- |
| Control System | System/set of devices that manages, commands, directs or regulates behaviour of other devices or systems to achieve desired results​ |
| Actuator/Output Transducer | Component of a machine that is responsible for moving and controlling a mechanism or system. Requires a control signal and a source of energy. |
| Sensor | Device that converts a physical stimulus into a readable output. Used to detect and measure some physical effect, providing this information to the control system |
| Analog Digital Convertor | Converts analog data from sensors (e.g. light, temperature) to digital data which computer can process |

## Random List of Sensors for Application

* Electrical current
* Humidity
* Load (Weighing/pressure plate)
* Magnetic
* pH
* Photoelectric
* Proximity
* Temperature
* Encoders (Rotations for wheels)
* Inductive loop (Induction for cars at traffic lights)

## Format for Feedback Loop/Control System

If you do not know how to answer question, you most likely can plonk this in.



* Desired \_\_\_\_\_\_ is set/Setpoint is determined
* Sensors measure output \_\_\_\_\_\_
* Signal sent back to microprocessor/controller
* Output proportional to the measured value
* Error (Difference between output to desired \_\_\_\_\_\_) calculated
* Microprocessor/controller determines the transducer output/output \_\_\_\_\_
* Repeated continuously

## Evaluation of Control Systems

### Advantages

* Can run perpetually as long as it is powered
* Consistent
* Can be used in dangerous places instead of humans
* Respond quickly to changes as computers process data quickly

### Disadvantages

* Software is specialised (Cannot be used in other applications)
* Power cut / malfunctions in hardware can cause failure
* Cannot react to unprecedented situations

## Open Loop vs Feedback Systems

|  |  |
| --- | --- |
| **Open Loop** | **Feedback** |
| Output has no influence or effect on the control action of the input signal, also includes feedforward control | All or part of the output signal is fed back to the input |
| E.g. Microwave set amount of time | E.g. Air conditioner controlling temperature |
| * Simple * Economic * Less Maintenance | * Reliable * Faster to get to setpoint * Multiple variables handled simultaneously * Can optimize |
| * Inaccurate * Unreliable * Slow to get to setpoint * Cannot optimize | * Expensive * Difficult to maintain |

# Distributed Systems

**Pros**

* Reliable
* Scalability
* High Performance

**Cons**

* High network infrastructure cost
* Software complexity – Difficult to troubleshoot
* Privacy and Security – Risk of sharing sensitive data is higher

# Embedded Systems

May be called “autonomous agents in a larger system” in the question.

## Definition

Performs specific function for a larger system it is a part of. (Give example in question context)

* Often based on microcontrollers
* Has inputs and outputs

## Social and Ethical Considerations

* Tagging prisoners
  + Could be hacked to track innocent people
  + Tracking data could be sold off to make money
* CCTV surveillance
  + Loss of privacy
  + Could be hacked and used for unintended purposes
  + Could be used to spy on people (drones)

# Interrupts

* Sensor sends interrupt signal when senses value outside normal range
* E.g. abnormal temperature/pressure
* Sends signal to transducer/actuator to normalize a system