



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT213 – IOT SYSTEM ARCHITECTURE

II YEAR/ IV SEMESTER



ACTUATORS

- An actuator is a component of a machine that is responsible for moving or controlling a mechanism or system.
- An actuator requires a control signal and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power.
- When the control signal is received, the actuator responds by converting the energy into mechanical motion.



ACTUATORS



- Following basic actuators are used for signaling and output purpose:
 - LED
 - RGB LED
 - Buzzer
 - Servo Motor
 - DC Motor
 - Relay



HYDRAULIC ACTUATORS



1. Hydraulic Actuators –

A hydraulic actuator uses hydraulic power to perform a mechanical operation. They are actuated by a cylinder or fluid motor. The mechanical motion is converted to rotary, linear, or oscillatory motion, according to the need of the IoT device. Ex- construction equipment uses hydraulic actuators because hydraulic actuators can generate a large amount of force.

Advantages :

- Hydraulic actuators can produce a large magnitude of force and high speed.
- Used in welding, clamping, etc.
- Used for lowering or raising the vehicles in car transport carriers.

Disadvantages :

- Hydraulic fluid leaks can cause efficiency loss and issues of cleaning.
- It is expensive.
- It requires noise reduction equipment, heat exchangers, and high maintenance systems.



PNEUMATIC ACTUATORS



2. Pneumatic Actuators –

A pneumatic actuator uses energy formed by vacuum or compressed air at high pressure to convert into either linear or rotary motion. Example- Used in robotics, use sensors that work like human fingers by using compressed air.

Advantages :

- They are a low-cost option and are used at extreme temperatures where using air is a safer option than chemicals.
- They need low maintenance, are durable, and have a long operational life.
- It is very quick in starting and stopping the motion.

Disadvantages :

- Loss of pressure can make it less efficient.
- The air compressor should be running continuously.
- Air can be polluted, and it needs maintenance.



ELECTRICAL ACTUATORS



3. Electrical Actuators –

An electric actuator uses electrical energy, is usually actuated by a motor that converts electrical energy into mechanical torque. An example of an electric actuator is a solenoid based electric bell.

Advantages :

- It has many applications in various industries as it can automate industrial valves.
- It produces less noise and is safe to use since there are no fluid leakages.
- It can be re-programmed and it provides the highest control precision positioning.

Disadvantages :

- It is expensive.
- It depends a lot on environmental conditions.



ThERMAL & MAGNETIC ACTUATORS



- **Thermal/Magnetic Actuators –**

These are actuated by thermal or mechanical energy. Shape Memory Alloys (SMAs) or Magnetic Shape-Memory Alloys (MSMAs) are used by these actuators. An example of a thermal/magnetic actuator can be a piezo motor using SMA.

- **Mechanical Actuators –**

A mechanical actuator executes movement by converting rotary motion into linear motion. It involves pulleys, chains, gears, rails, and other devices to operate.

Example – A crankshaft.

- Soft Actuators

- Shape Memory Polymers

- Light Activated Polymers

- With the expanding world of IoT, sensors and actuators will find more usage in commercial and domestic applications along with the pre-existing use in industry.



ANALOG SENSOR INTERFACING



Connection of Analog Sensor with Arduino

All sensors have their own method to connect with Arduino. Some of them need pull-up resistors, some need a certain power supply to use them. But any sensor has generally 3 pins to connect to Arduino or other development board. These pins are.

1. +Vcc
2. Signal
3. Gnd

Hook up the +Vcc to 5v (or 3.3v if sensor demands it) on your Arduino board.

Connect the Gnd pin to Ground pin on your Arduino.

Connect the Signal pin to any of your Arduino's analog pins. In our case, say A1.



CODE FOR INTERFACING ANALOG SENSOR WITH ARDUINO



```
void setup()
```

```
{
```

```
  Serial.begin(9600);
```

```
}
```

```
void loop()
```

```
{
```

```
  int sensorValue = analogRead(A1);
```

```
  Serial.println(sensorValue);
```

```
  delay(1);
```

```
}
```