Introduction to robots and robotics

Robot Teaching

To provide necessary instructions to the robot

Teaching methods

Online Methods

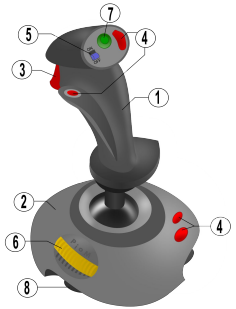
Off-line Methods
(Programming Language)

Manual teaching
(point to point task)

- Control handle/ Joystick (error and trail:optical encoder)
- Push buttons (director and controller)
- Teach-pendant(remote controller)

Lead-through Teaching
(continuous path task)

- Robot simulator



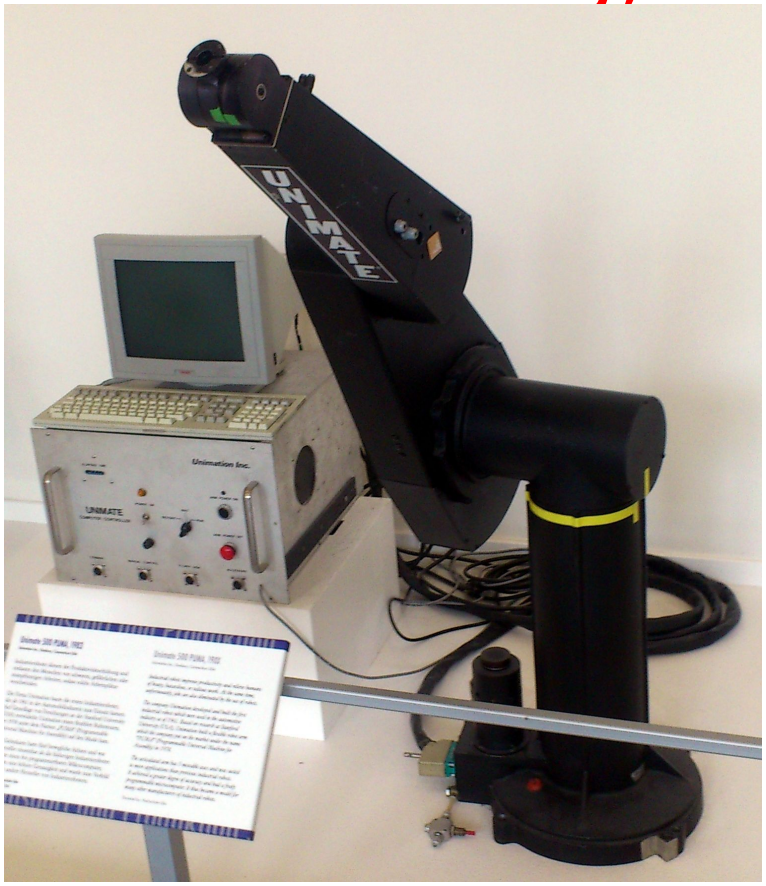
PUMA (Programmable Universal Machine for Assembly)

VAL Programming for PUMA

Task : Pick and Place operation

VAL program

```
APPRO PART, 100
Moves Part
Closel
Departs 200
Appros Bin, 300
Move bin
Openl
Depart 100
```



https://www.youtube.com/watch?v=aHV5oY7viBM

Specification of a Robot

- ★ Control type
- ★ Drive system
- ★ Coordinate system
- ★ Teaching/ Programing methods
- ★ Accuracy, Repeatability, Resolution
- ★ Payload capacity
- ★ Weight of the manipulator
- ★ Applications
- ★ Range and speed of arms and wrist
- ★ Sensors used

Economic Analysis

- ★ **Let F:** Capital investment to purchase a robot which includes its purchasing cost and installation cost
- ★ **B:** Savings in terms of material and labour cost
- ★ **C:** Operating and maintenance cost
- ★ **D:**Depreciation of the robot
- ★ **A:**Net savings

$$A=B-C-D$$

G: tax to be paid on the net savings

Pay-back period, E=(Capital investment, F)/(B-C-G)

Economic Analysis

- **Let I:** Modified net savings after the payment of tax
- **Rate of return on investment**
  - **H=(I/F)*100%**

A company decides to purchase the robot, if

- Pay-back period< techno-economic life
- Rate of return on investment > rate of bank interest

Numerical Example-1

The costs and savings associated with a robot installation are given below.

- Costs of a robot including accessories:Rs. 12,00,000
- Installation cost: Rs. 3,00,000
- Maintenance and operating cost:Rs. 20 per hour
- Labour saving : Rs. 100 per hour
- Material Saving:Rs. 15 per hour

The shop runs 24 hours in a day (in 3 shifts) and the effective workdays in a year are 200. The tax rate of the company is 30% and techno-economic life of the robot is expected to be equal to six years. Determine

- Payback period of the robot and
- Rate of return on investment

Numerical Example-2

The costs and savings associated with a robot installation are given below.

1. Costs of a robot including accessories:Rs. 6,00,000
- Installation cost: Rs. 1,00,000
- Maintenance and operating cost: Rs. 10 per hour
- Labour saving : Rs. 80 per hour
- Material Saving: Rs. 18 per hour

The shop runs 24 hours in a day (in 3 shifts) and the effective workdays in a year are 210. The tax rate of the company is 28% and techno-economic life of the robot is expected to be equal to six years. Determine

- Pay-back period of the robot and
- Rate of return on investment