

The background of the slide features a blue gradient with several reflective spheres of varying sizes and a bright light source in the center emitting rays of light.

Programmable Logic Controller (Mitsubishi)

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❖ Lecturer:

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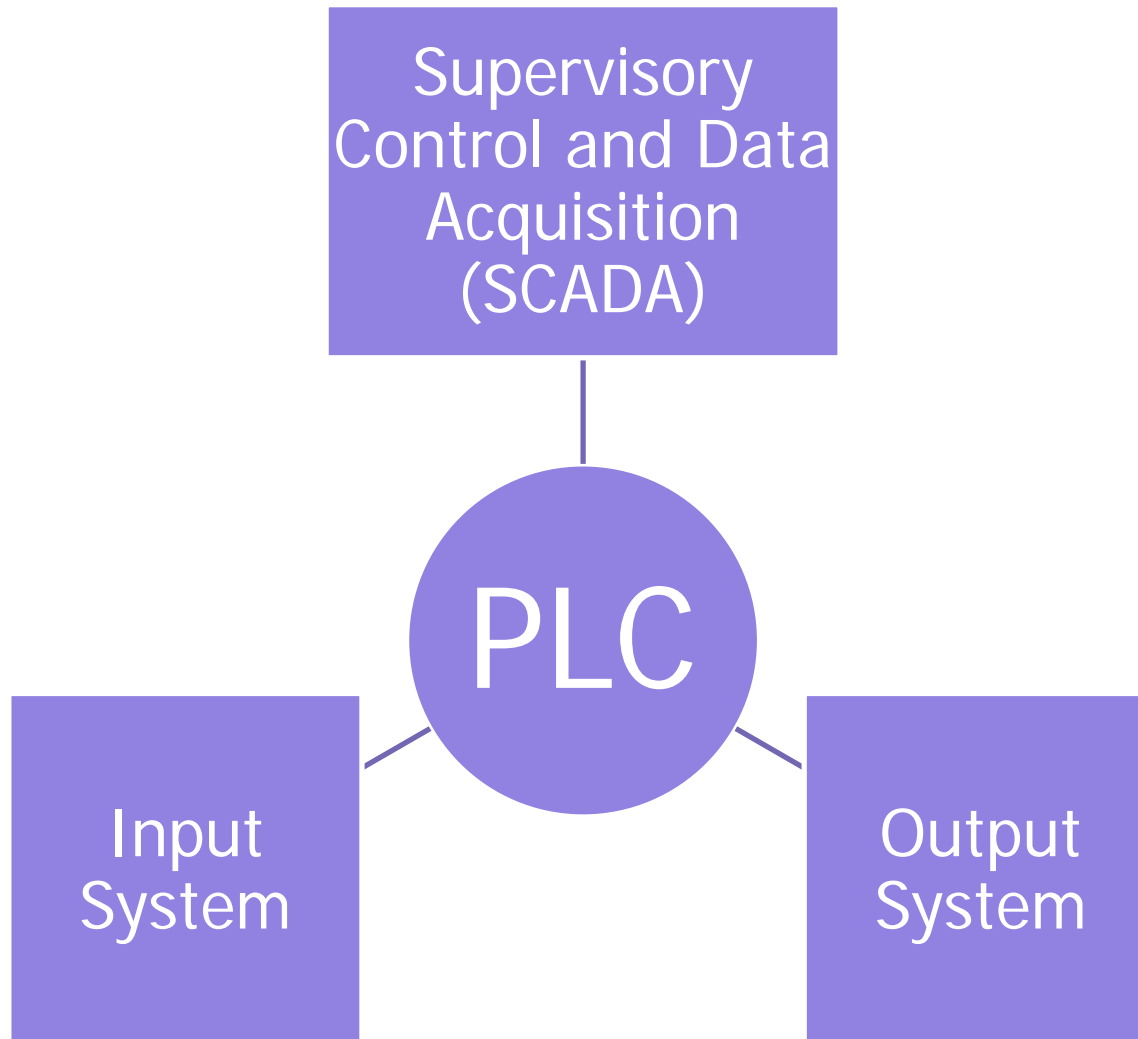
❖ Assessment scheme:

- Class participant, Homework, Exercise: 30%
- Experiment: 20% (3 experiments)
- Group project: 10%
- Final exam: 40%

Learning Outcomes



- ❖ **Know the structure and working principles of a PLC.**
- ❖ **Select the suitable components and make the wiring diagram for a system.**
- ❖ **Produce control flowchart for control system and write a program for the given system.**
- ❖ **Have an ability to illustrate a system.**
- ❖ **Have an ability to design a PLC based system with given requirements.**



- ❖ **Chapter 1:** Introduction to Programmable Controller
- ❖ **Chapter 2:** Number systems and codes (self-study)
- ❖ **Chapter 3:** PLC hardware (physical components)
- ❖ **Chapter 4:** Memory system and Input/Output interaction
- ❖ **Chapter 5:** Digital/Analog Input/Output system
- ❖ **Chapter 6:** Special Modules
- ❖ **Chapter 7:** How to install GX Developer
- ❖ **Chapter 8:** PLC Programming language – Basic instructions
- ❖ **Chapter 9:** PLC Programming language – SFC/STL instructions

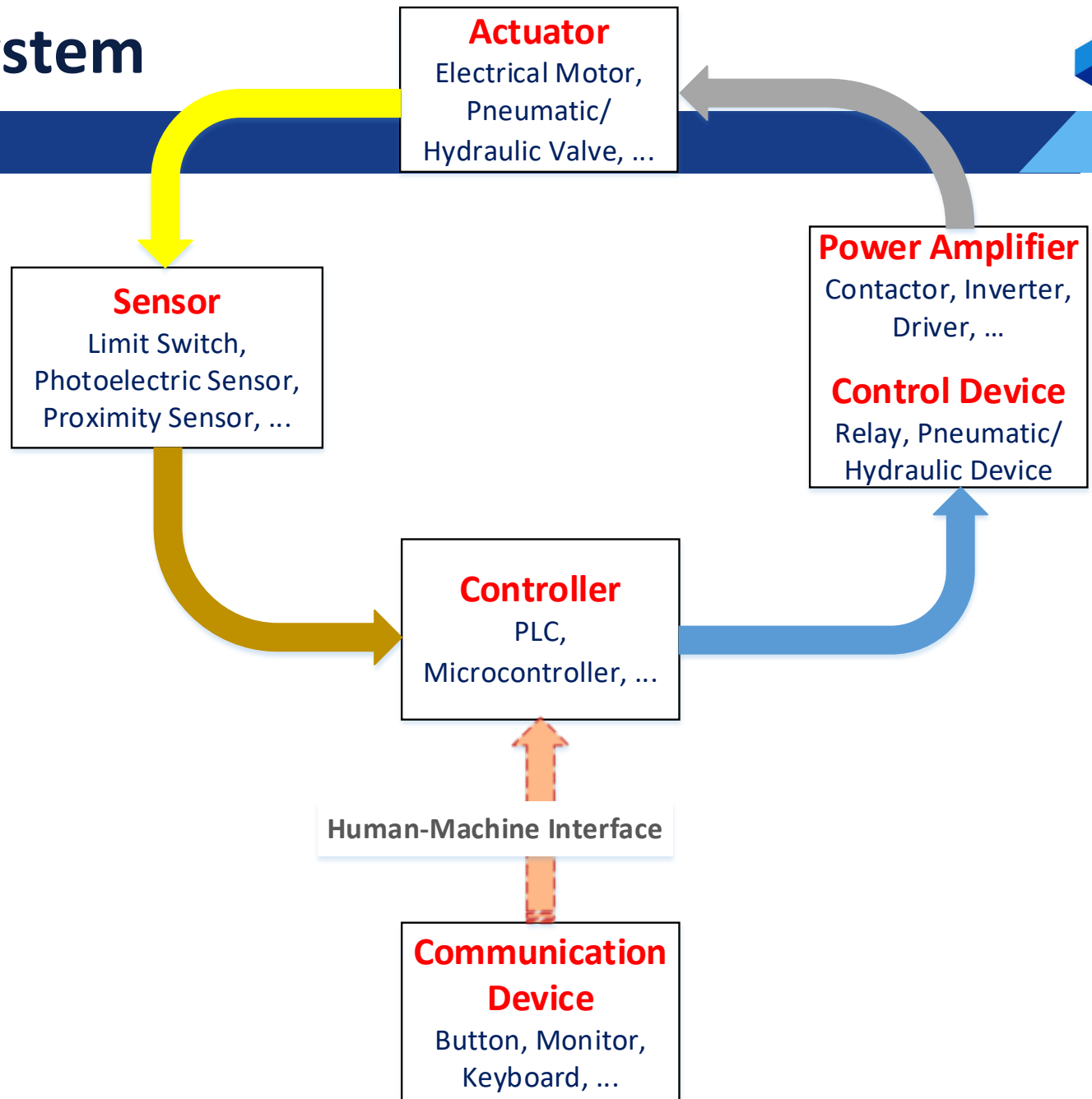
[1] L. A. Bryan and E. A. Bryan, *Programmable Controllers: Theory and Implementation*, An Industrial Text Company Publication.

[2] Mitsubishi Automation website:
[http://www.mitsubishielectric.com/fa/products/cnt/
plc/index.html](http://www.mitsubishielectric.com/fa/products/cnt/plc/index.html)

The background features a blue gradient with several glowing spheres of varying sizes. A bright light source in the center emits horizontal rays of light, creating a sense of depth and motion.

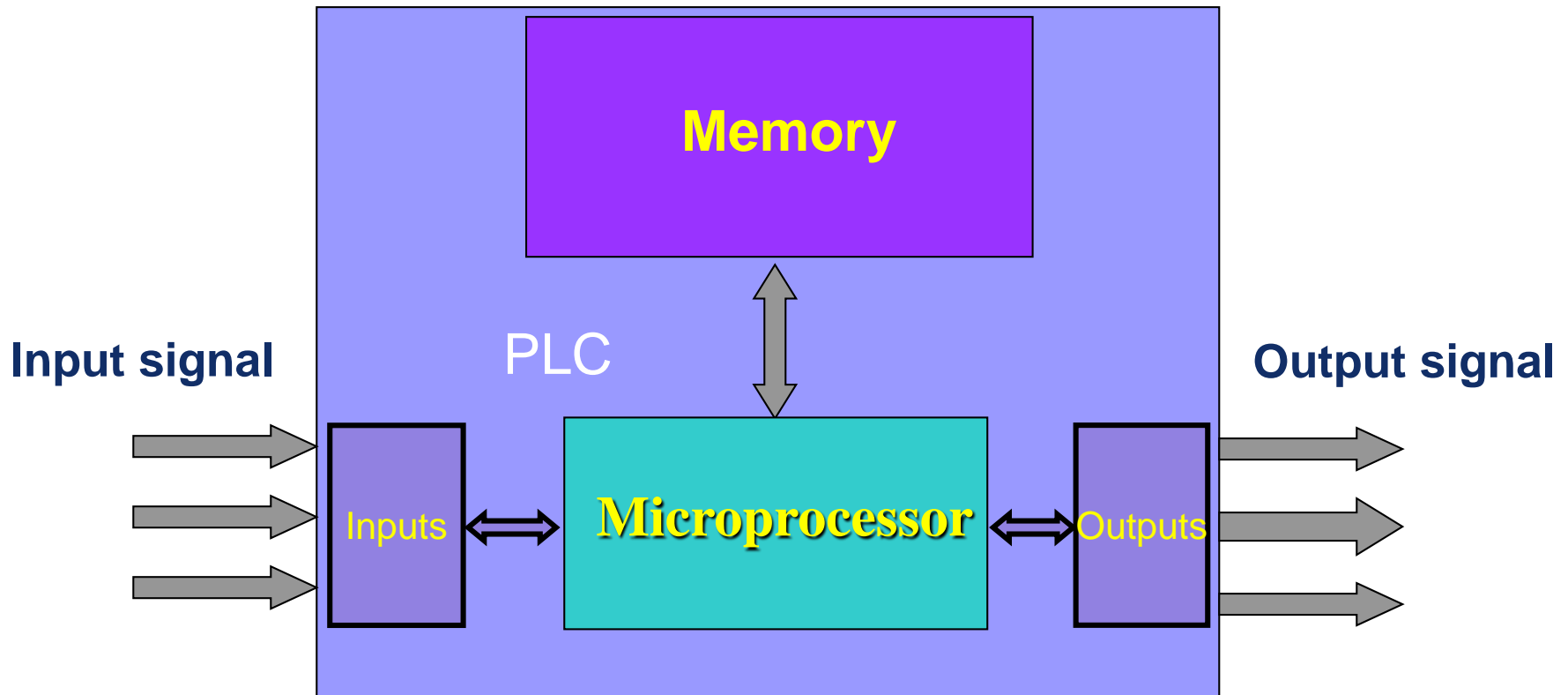
Chapter 1: Introduction to Programmable Logic Controller

Control System



Programmable Logic Controller (PLC)

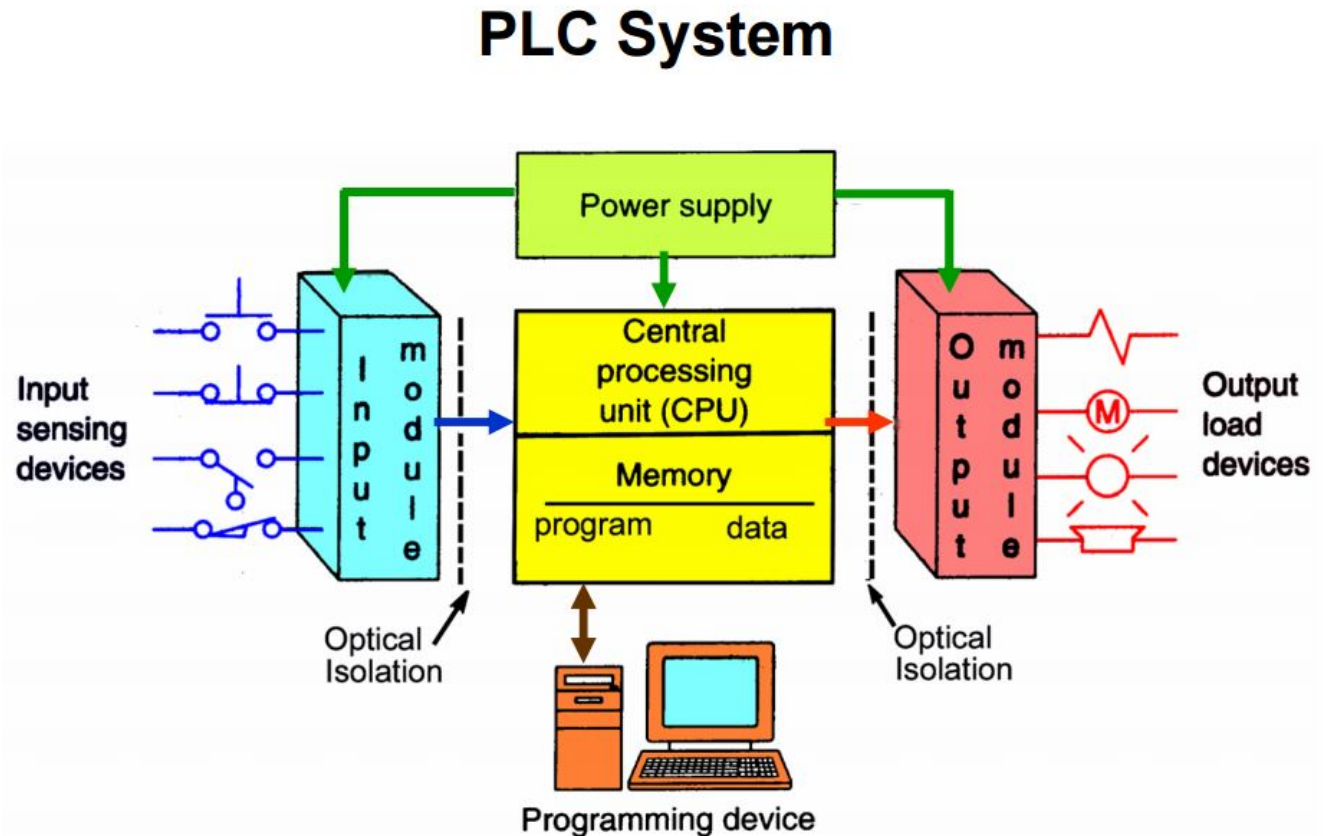
- ❖ **Programmable logic controller**, also called *programmable controller* or *PLC*, are **solid-state** members of the computer family, using integrated circuits instead of electromechanical devices to implement control functions.



Programmable Logic Controller (PLC)

❖ The basic structure of a PLC:

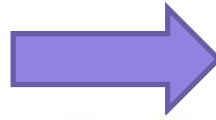
- Power supply.
- Memory.
- CPU.
- I/O modules.



Programmable Logic Controller (PLC)



Relay circuits

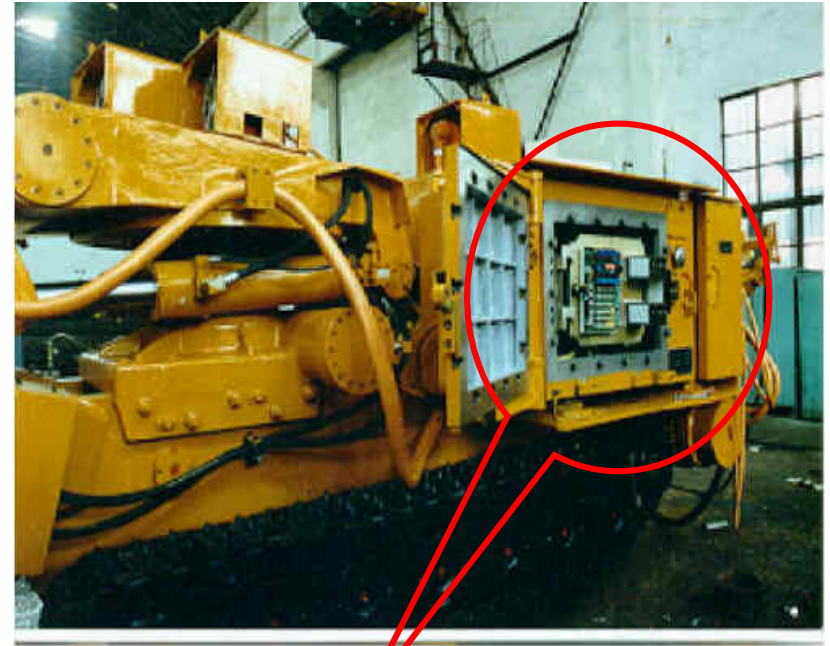


PLCs in 1960s



PLCs in 2010s

PLC Applications



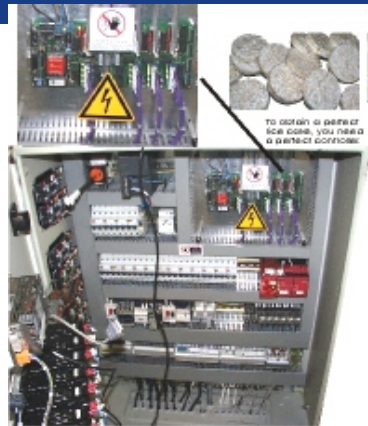
PLC

Mining machinery

PLC Applications



Outside of the electrical box. HMI linked to the TRI-PLC for an operator friendly machine.



Inside view of the electrical box with the TRI-PLC. Thanks to this solution we provide a powerful and easy to install controller, saving a lot of space regarding to other systems.

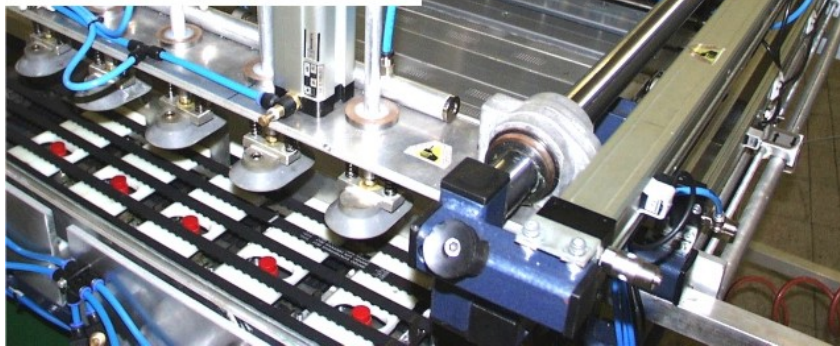
← Cookies making machine

Labelling machine

Nice and good working wrap around labeler. Automated with TRI-PLC



Automation and hardware build by RIDDER'S



Electrical control box based on the TRI-PLC



Finished product, speed = 25 / min



Finished product, speed = 25 / min



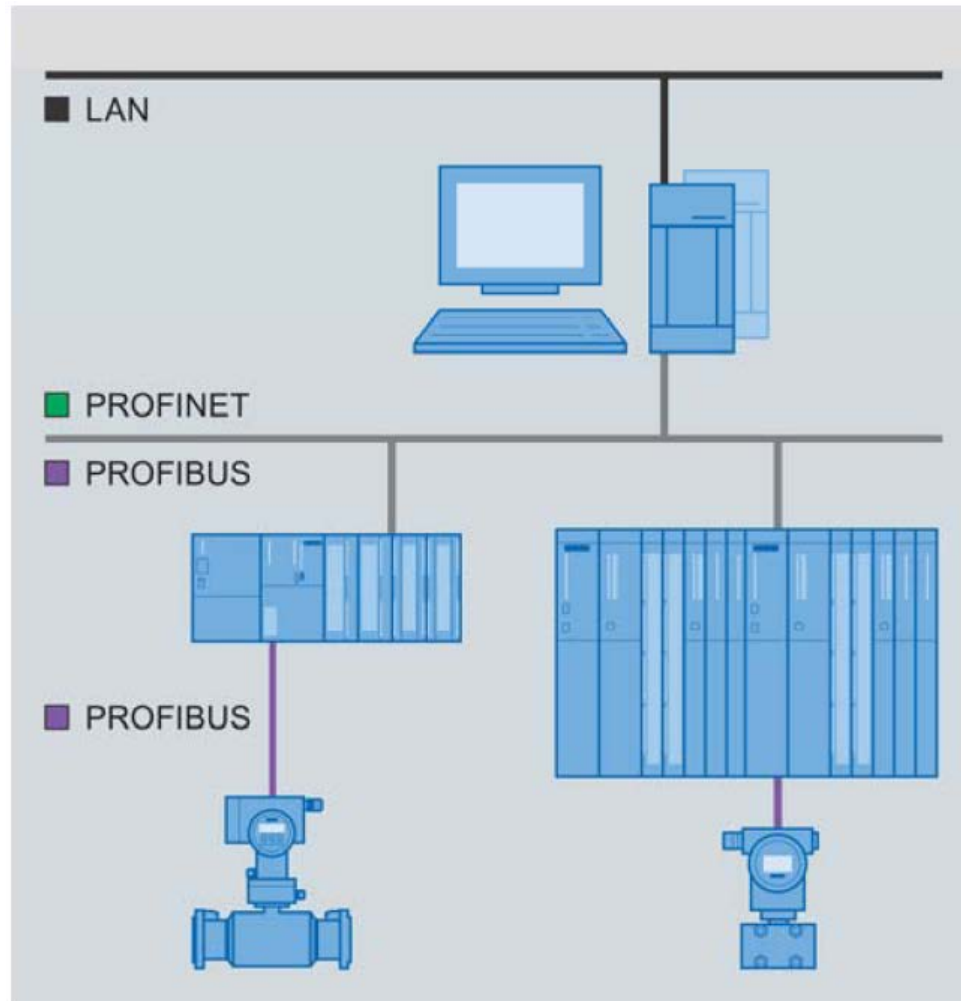
HMI for an easy communication between man and machine



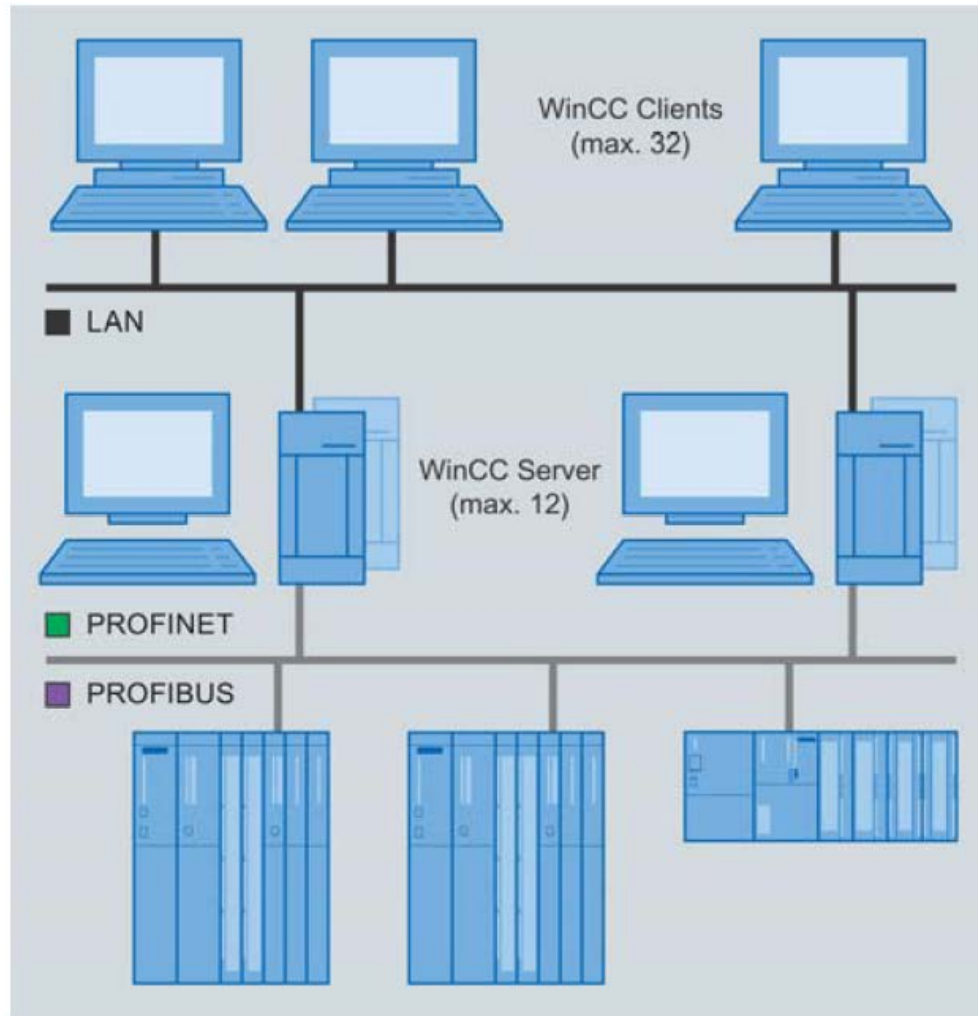
T100MD1616+ & EXP4040

- ❖ **Manufacturing / Machining**
- ❖ **Food / Beverage**
- ❖ **Metals**
- ❖ **Power**
- ❖ **Mining**
- ❖ **Petrochemical / Chemical**

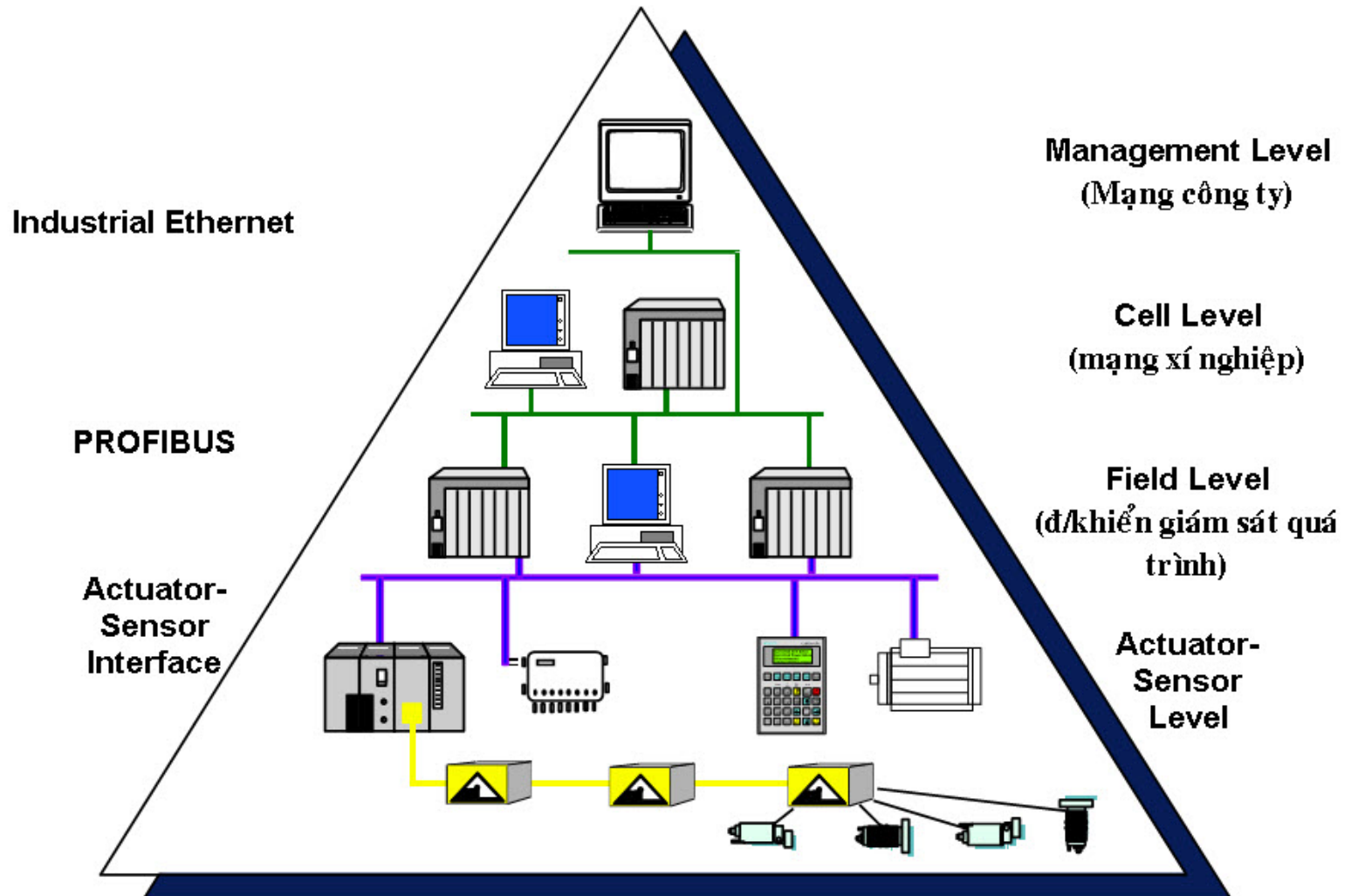
Single level PLC Control System



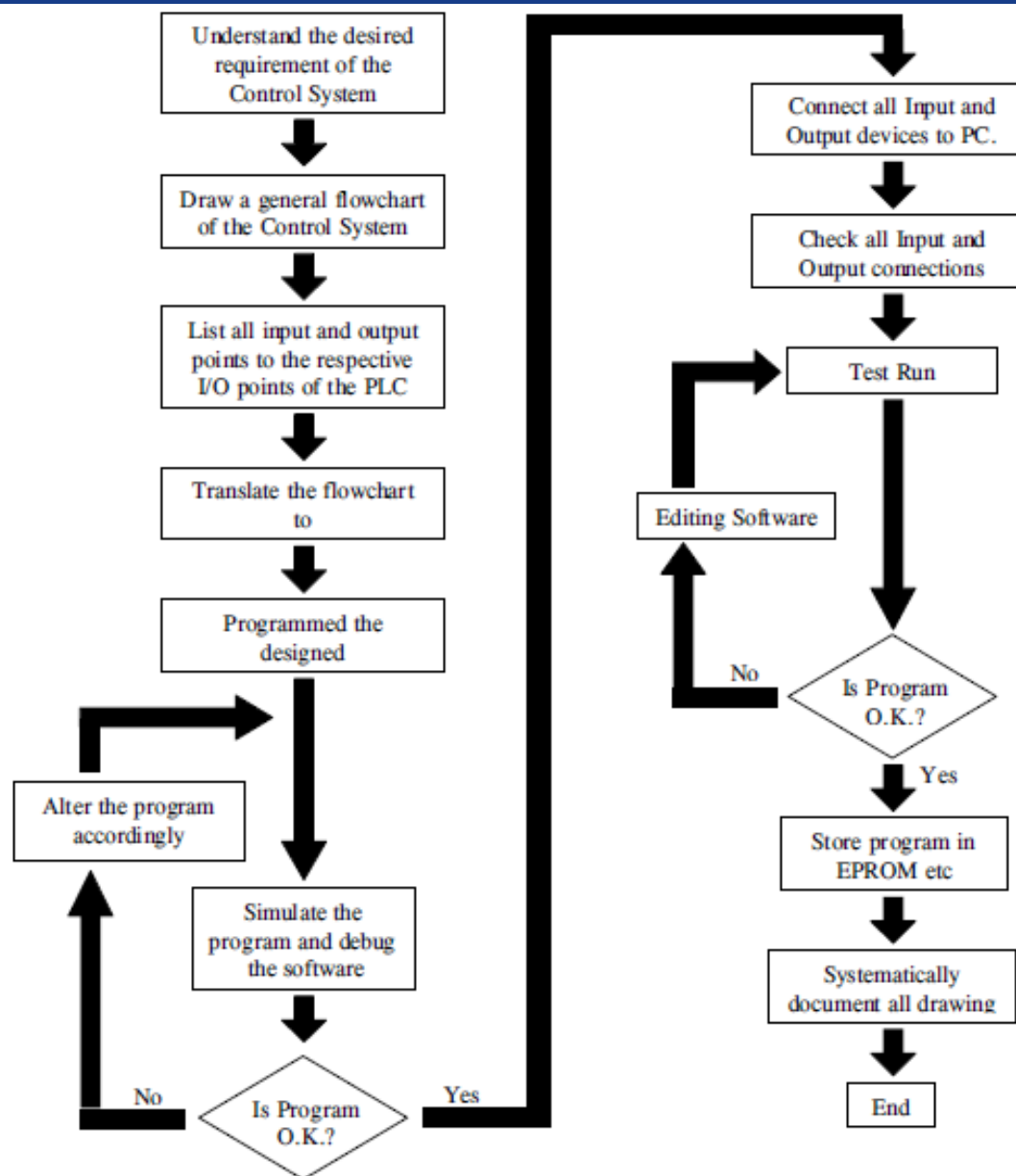
Multi-level PLC Control System



System Hierarchy

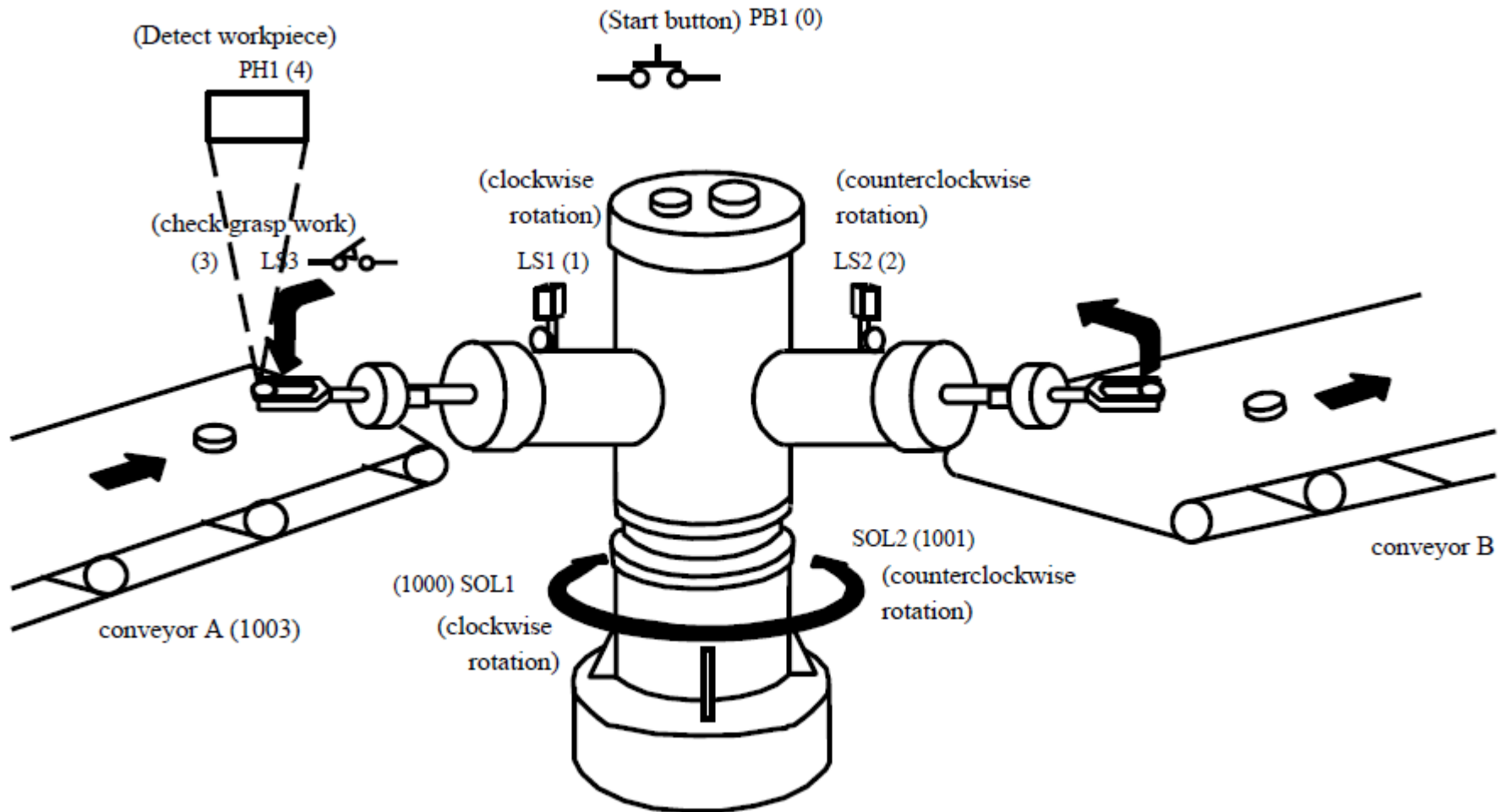


A Systematic Approach to PLC Design

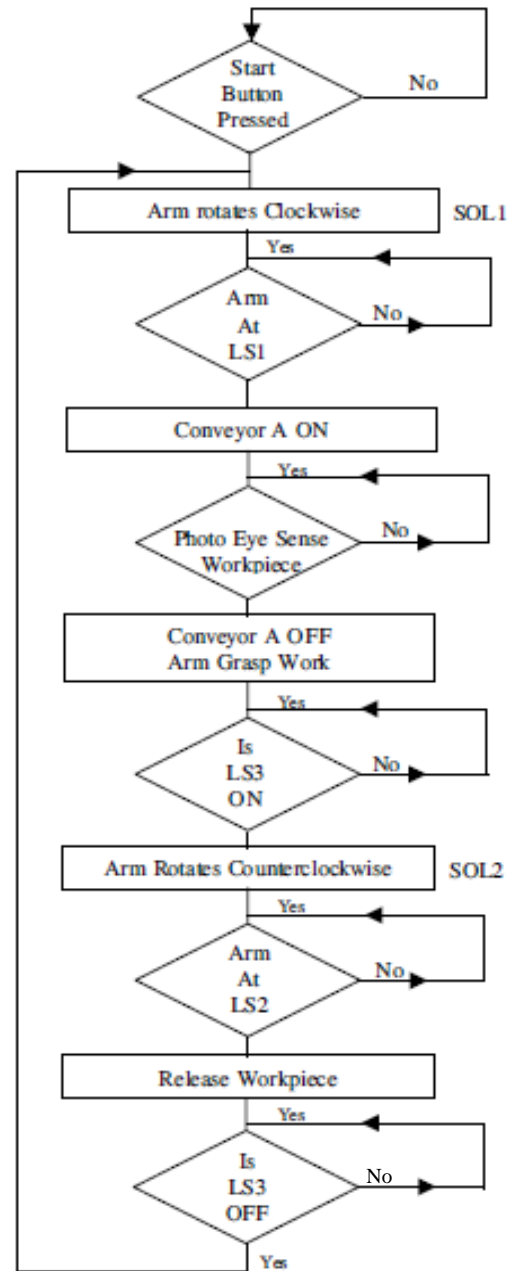


Example

❖ Control the following robot's movement

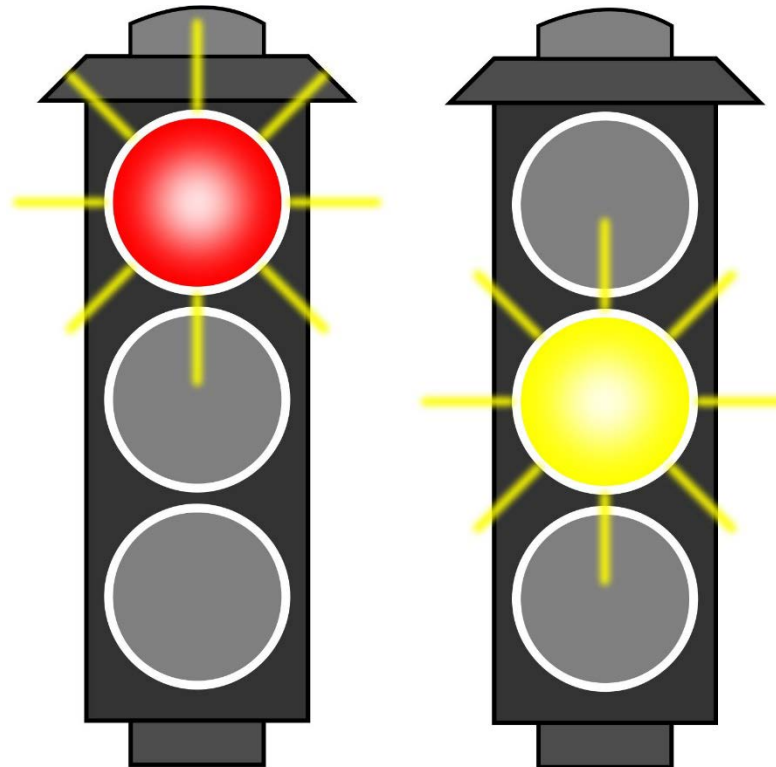


Flowchart of controlling robot's movement



- ❖ Draw a flowchart of traffic light with the following requirements:

Green: 15s, Yellow: 5s, Red: 20s



```
graph LR; A([PLC based system advantage]) --- B([No wiring for control circuit]); A --- C([Flexible, easy to change]); A --- D([Small space occupying]); A --- E([Plenty of control functions]); A --- F([High processing speed]); A --- G([Low power consumption]); A --- H([Easy installing]); A --- I([Expendable]); A --- J([Compatible price]);
```

PLC based system advantage

No wiring for control circuit

Flexible, easy to change

Small space occupying

Plenty of control functions

High processing speed

Low power consumption

Easy installing

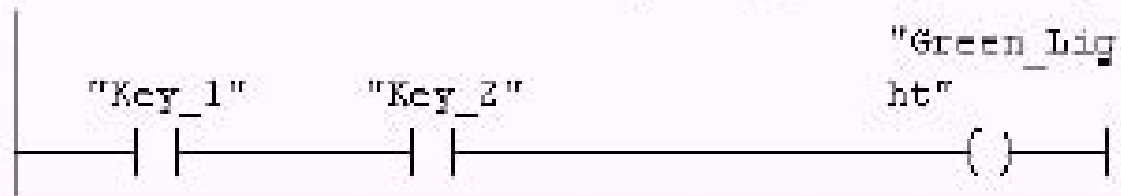
Expendable

Compatible price

❖ LAD

Ladder Logic (LAD)

Suitable for users from the electrical engineering industry, for example.



- Electric based language
- Preferred by mechanical engineer

❖ Instruction

```
LD      X000
OUT     T0      K100
LD      T0
OUT     Y000
END
```

Statement List (STL)

Suitable for users from the world of computer technology, for example.

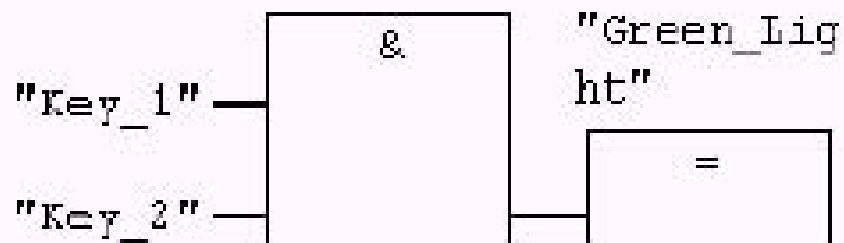
```
A      "Key_1"
A      "Key_2"
=      "Green_Light"
```

- Use commands
- Preferred by IT programmers

❖ FBD

Function Block Diagram (FBD)

Suitable for users from the world of circuit engineering, for example.



Preferred by digital circuit designer.

❖ GRAFCET

- Sequential Function Chart (SFC)
- SStep Ladder (STL)

- Flowchart type
- Well structure
- Well organize
- Easy to check

