

Robotics Centre

In the present educational system, there is a huge gap is present between the educational institutions and the Industries. To minimize that gap, C.V. Raman College of Engineering and ED Co. Ltd of South Korea had entered into a common understanding of collaboration with a focus on strengthening Technology Training and improving educational systems. As a result CVRCE Robotics Centre has been established.

As per the agreement:

1. ED will seek to provide technology transfers in order to enhance the technical knowhow to CVRCE in the areas: Robotics Education Technology, Manufacturing Automation Technology, Electrical, and Electronics and in other Engineering departments.
2. CVRCE has purchased different types of trainer kits related to Robotics and Industrial Automation.
3. ED has provided group technical training to CVRCE faculties in Korea.
4. ED is willing to support CVRCE's vision of becoming a specialized support centre for Robotics training. This centre will increase the efficiency of the college and attract talented candidates to the fast paced field of Robotics.

Student Course at CVRCE Robotics Centre

1. MECHANICAL ENGINEERING

- PRACTICAL LEARNING OF BASIC ELECTRICAL, ELECTRONICS, AND SENSORS WITH MORE EMPHASIS ON MECHANICAL CONCEPTS.
- UNDERSTANDING THE COMPLETE PRODUCT DEVELOPMENT LIFE CYCLE WITH PRACTICAL HANDS ON EXPERIENCE.
- HANDS ON EXPERIENCE WITH BUILDING PLANT AUTOMATION USING PLC.

2. CIRCUIT ENGINEERING (ETC / AEI / CSE / IT)

- PRACTICAL LEARNING OF BASIC ELECTRICAL, ELECTRONICS, SENSORS AND EMBEDDED PROGRAMMING.

- HANDS ON UNDERSTANDING OF SOFTWARE DEVELOPMENT CYCLE BY DEVELOPING A WEB APPLICATION FOR ROBOTS.
- DEVELOPING IMAGE PROCESSING APPLICATION FOR PRACTICAL UNDERSTANDING OF DISTRIBUTED COMPUTING IN REAL WORLD APPLICATIONS USING ROBOTS.

Training Modules

The total training of the Robotics is divided into 3 modules. Module-1 is for the 3rd semester students, module-2 is for 4th semester students and module-3 is for the 5th semester students of the Engineering stream. The content of different training module is given below.

Module-1: Motor and Sensor

1. Introduction to Motors and Motor Encoders
2. **Inverter Motor (Induction Motor 3 ϕ)**
 - a. Single Phase to 3-phase conversion
 - b. Induction Motor principle
 - c. Induction Motor Control
3. **DC Servo Motor**
 - a. Principle of DC Motor
 - b. DC Servo Mechanism
 - c. DC Servo Motor Control
4. **AC Servo Motor**
 - a. Principle of AC Motor
 - b. AC Servo Mechanism
 - c. AC Servo Motor Control
5. **Stepper Motor**
 - a. Principle of Stepper Motor
 - b. Stepper Motor Mechanism
 - c. Stepper Motor Control
6. **Sensor Signal Conditioning**

- a. Introduction to Sensors
- b. Sensor Signal conditioning Electronics Circuits
- c. Sensors Experiments

Module-2: Robot Control

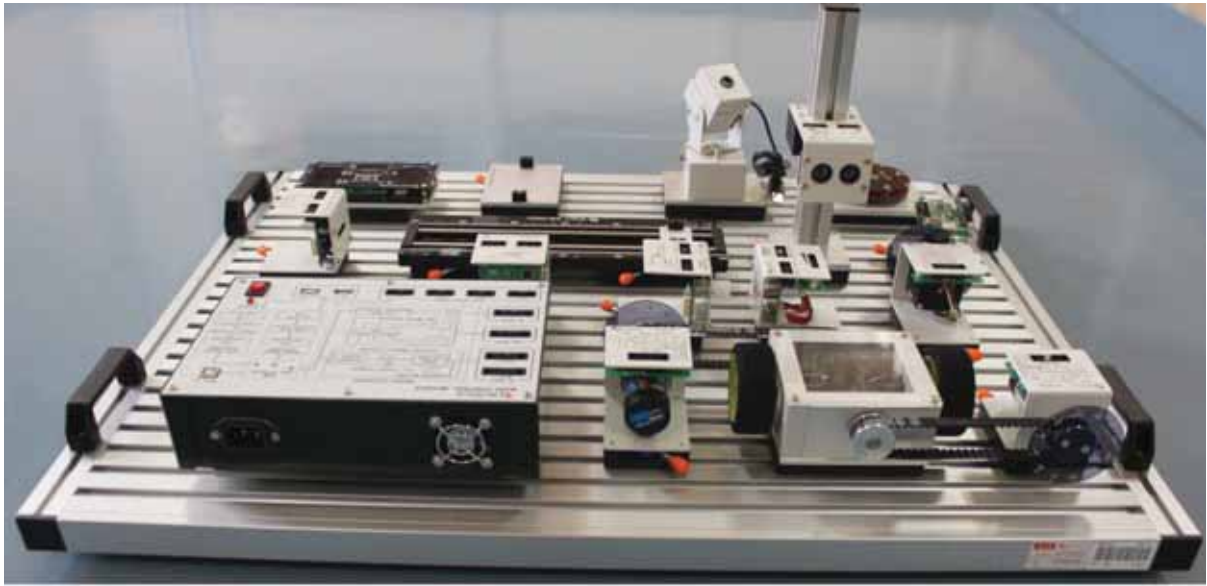
1. Introduction to ROBOTICS
2. Types of the Robots
3. Different types of Micro-controller (ATMEGA)
4. Programming and Burning of ATMEGA Micro-controller
5. VC++ Programming to Control Robots
6. Experiments using Intelligent Robotics Trainer Kit
7. Robot Designing using Robot Developer Kit
8. Programming to control Mobile Omni-directional Robots

Module-3: PLC (Programmable Logic Control)

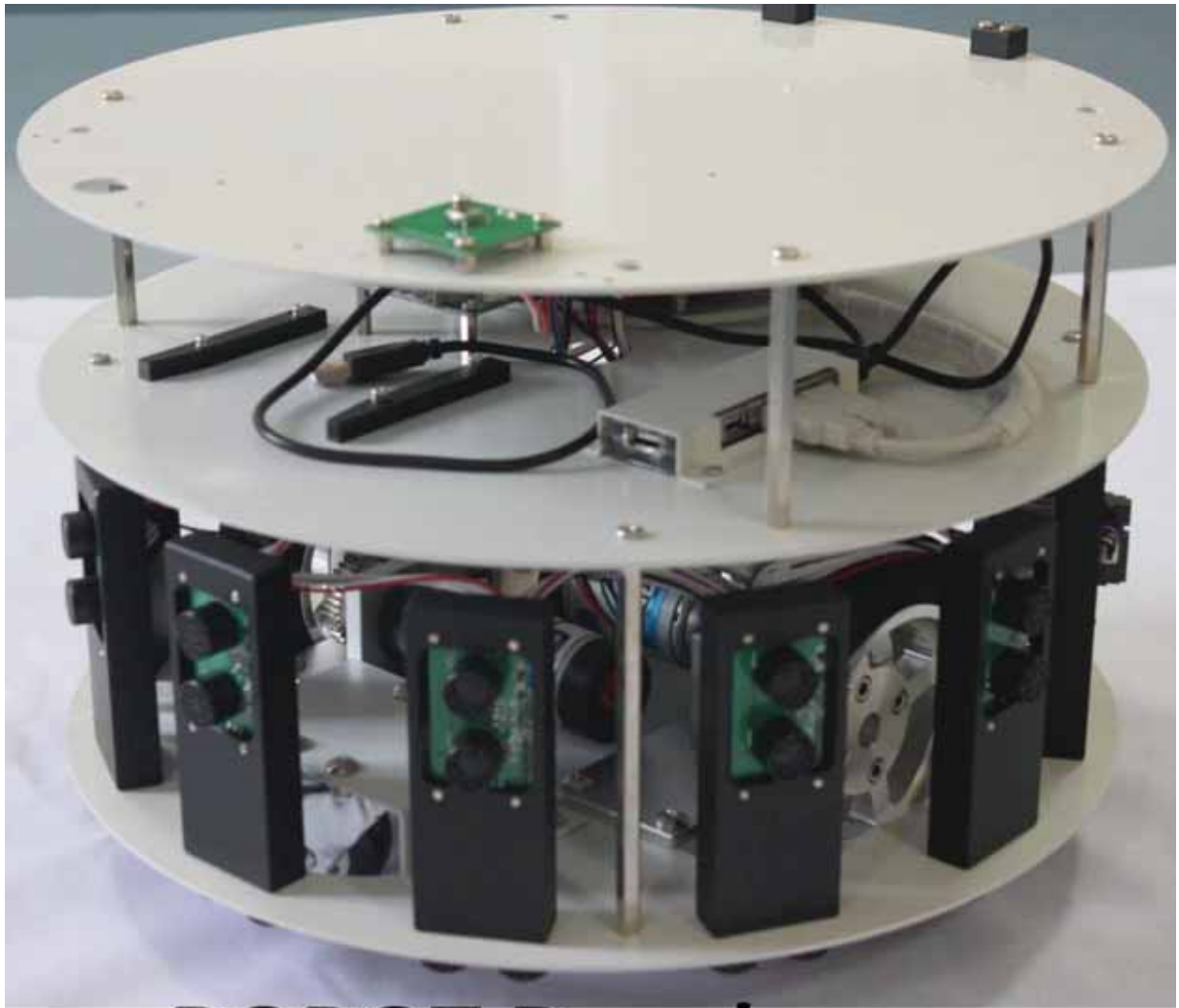
1. Introduction to PLC
2. Types of the PLC
3. PLC Architecture
4. Input & Output of PLC
5. PLC Programming
6. PLC Interfacing of:
 - a. Conveyor Simulator Trainer Kit
 - b. Stepper Motor Trainer Kit
 - c. Inverter Trainer Kit
 - d. AC Servo Motor Trainer Kit
 - e. DC Servo Motor Trainer Kit

Equipments present in the Robotics Centre

ROBOTS



Intelligent ROBOT



ROBOT Developer



5-Axis ROBOT



OMNI-DIRECTIONAL ROBOT



OMNI-DIRECTIONAL ROBOT

MOTOR MODULE

AC Servo Motor Trainer

A servomotor is a rotary actuator that helps in precise control of angular position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Experiments on Servo Motor control techniques using Servo Driver (Samsung) (Small-sized, light-weighted, and power source-integrated product in Full Digital Method using 32-bit high speed DSP)

JOG operation, PLC control operation, PC control operation

Linear Motion Guide and Rotary Encoder for position control

Edge detection by Roller type Limit Switch



KEY SPECIFICATIONS:

AC SERVO MOTOR

SAMSUNG CSMT
(100W Class Motor)

- Rated output: Single Phase AC 220V
- Rating/Max. Speed: 3000 RPM
- Current (continuous): 1.0A, Max. 3.0A
- Weight: 0.4 Kg
- Applied encoder: 17 bit serial encoder (Incremental, Absolute)

SERVO DRIVER

- Main Circuit Power Source
 - » 3-Phase 220V(+10%, -15%, 50/60MHz)
- Control Type : PWM control using IPM
- Encoder
 - » 2048/2500/10000 Pulse/Rev. (Incremental, Absolute)
- Dynamic Brake
 - » Servo/Controller off
 - » Operable with the built-in alarm activated

SERVO DRIVE CONTROL

- Velocity Control Range : 1 : 5,000
- Frequency Alteration : 550Hz
- Acceleration/Deceleration Time Constants Setting
 - » 0~60 sec
- Input Signal : Sine+Pulse, 90° phase difference
- Pulse Types : 2-phase Pulse (A+B), CCW Pulse, CW Pulse
- Pulse Forms
 - » Line Drive(+5V), Open Collector(+5, +12V, +24V)

Robotics Centre

Sensor Modules
Motor Control Modules
Application Modules

DC Servo Motor Trainer

A servomotor is a rotary actuator that allows for precise control of angular position, velocity and acceleration.

Servomotors are specifically used in applications such as ROBOTICS, CNC machinery or automated manufacturing.

Graphical display of functional block diagram on the surface

Speed and angle control by step operation and photo sensor

Display of the rotational speed and angle data using LCD

PC control and waveform output functions



KEY SPECIFICATIONS:

KEY FEATURES

- Motor Speed Control by PID Controller
- PWM operation method
- Speed control by the change of output pulse frequency
- Position and speed controls by feedback
- Controls forward/reverse rotation by positive supply voltage input
- Monitor and control the characteristics of operation by the software
- Measurement of the motor's load characteristics using a brake
- Speed and Angle control by step operation and Photo sensor
- RS-232C PORT PC Interfacing
- Built-in 4-channel A/D Converter
- Built-in 1-channel D/A Converter
- LCD based display to monitor angle and speed.
- Encoder output and various types of output pulse measurement
- Eddy current based breaking system.

DC SERVO MOTOR

- Rating Output: 100W
- Encoder: Built-in Rotary Encoder (500 Pulses/ Revolution)
- Speed: 0-3000RPM

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Sensor Modules
Motor Control Modules
Application Modules

Stepper Motor Trainer

A stepper motor is a brushless, synchronous electric motor that converts digital pulses into mechanical shaft rotation.

Every revolution of the stepper motor is divided into a discrete number of steps. The stepper motor can only take one step at a time for a precise angle which is controlled without any feedback mechanism.

Graphical display of functional block diagram on the system surface

Real-time monitoring and control by PC Control Program

LM Guide and Rotary Encoder for position control

Displays moving distance and angle data using LCD



KEY SPECIFICATIONS:

COMPUTER CONTROL

- Step/continuous operation by Control Program
- Direct/reverse rotation operation by Control Program
- Output pulse frequency operation by Control Program
- RS 232 Port PC interfacing for real-time monitoring and control
- Photo Sensor based limit detection system
- Built-in port to monitor Encoder output

MOTOR AND LM GUIDE

- 2-phase HB type, unipolar operation, 0 ~ 2000 PPS
- LM GUIDE operation (position control) and Circular Board operation (angle control)
- LM GUIDE(1set)
 - » Ball screw distance: 200mm
 - » Protection Circuit By Photo Sensor
- Rotary Encoder
 - » 400 Pulse/Revolution
 - » LCD based display system to monitor position and angle

MANUAL CONTROL

- Step/continuous operation by the values set manually
- Direct/reverse rotation operation by the values set manually
- Output pulse frequency Operation by the values set manually

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Sensor Modules
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Application Modules

Inverter Motor Trainer

AC motors (Induction or Asynchronous Motor) are powered by AC electricity, and their speed is controlled by the frequency of the AC current. An AC inverter Motor turns line voltage AC power into whatever frequency the motor requires to run at a particular speed.

Inverter Duty Motors are designed for optimized performance to run with variable frequency drive. The Inverter Duty Motors have independent cooling fan to cool down the motor. It can operate for wide speed range without any heating problem.

3-Phase Induction Motor interfacing with iG5 Inverter.

Practical training on Inverter and 3-Phase induction Motor operation.

Speed control of Induction Motor by PLC interfacing.



KEY SPECIFICATIONS:

CONTENT

- 0.5HP class single-phase inverter & ¼HP class AC geared motor
- Digital MMI, Trip-less operation, shortest/optimum acceleration and deceleration functions
- Built-in functions such as PID control and reliable operation
- Built-in RS485 as standard

IG5 INVERTER

- Maximum Applicable Motor:
 - » 0.5HP or 0.4KW
- Output Rating
 - » Rating Capacity : 0.95kVA at 2.5A
- Input Rating
 - » Voltage : 1-phase 200–230V
 - » Frequency : 50Hz–60Hz(±5%)
- Inverter Weight : 0.77kg
- Control Method : VF Type
- Frequency Setting Resolution
 - » Digital : 0.01Hz(below 100Hz), 0.1Hz(over 100Hz)
 - » Analog : 0.03Hz/60Hz
- Frequency Measure
 - » Digital : 0.01% of Max. Output
 - » Analog : 0.1% of Max. Output Frequency

- VF Ratio
 - » Linear, 2nd degree speed reduction, User V/F
- Operation Method
 - » Selectable : Keypad, Terminal, Communication
- Frequency Setting
 - » Analog : 0–10V/4–20mA
 - » Digital : Maneuver by Keypad

AC GEARED MOTOR

- Rated Output : ¼HP, 0.2kW
- Input Voltage : 3-phase 220/380V
- Rated Current : 1.1/0.64A
- Frequency : 60Hz
- Weight : 6kg
- Speed : 1720RPM
- Speed Decelerator : 10:1

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Sensor Modules
Motor Control Modules
Application Modules

SENSOR MODULES

Sensor Application Trainer

Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals.

A sensor converts the physical parameters (for example: Temperature, Blood Pressure, Humidity, Speed, etc.) into a signal which can be measured electrically.

Various types of sensors such as Temperature, Photo, Hall and Proximity

Signal detection, Signal Amplification and Conversion electrically.



OPERATIONAL AMPLIFIER UNIT



A/D CONVERTER



TEMPERATURE SENSOR



PHOTO SENSOR



ROTATION SENSOR



ULTRASONIC SENSOR



GAS SENSOR



HUMIDITY SENSOR



PRESSURE / PROXIMITY / HALL SENSOR



SENSOR SWITCH

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PLC MODULE

PLC Trainer Kit

A programmable Logic Controller (PLC) or Programmable Controller is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides or light fixtures.

Docking System architecture separating the main body from the PLC module

ALLEN-BRADLEY SLC-500 PLC Programming and Execution

Modular PLC System with GLOFA-GM4 PLC Unit

32 inputs/32 output points

4-digit LED based monitoring for the internal data

Various types of Programmable Logic Controller experiments

Modular structure for convenient storage and mobility

Built-in multi connection device compatible with GLOGA-GM4 PLC



- **Programming language:** LD (Ladder Diagram), IL (Instruction List), SFC (Sequential Function)

- **Computing speed:** 0.2 μ s/command or 0.2 μ s/step

- **Program memory capacity:** 128 bytes (32k step)

- **Operation mode:** RUN, STOP, PAUSE, DEBUG

- **Self-diagnosis function:** Operation delay monitoring, memory error, Input/output error, Battery error, Power supply error

KEY SPECIFICATION of GLOFA-GM4:

- **Control method:** Stored program method, Repetitive operation, fixed cycles operation, Interrupt operation

- **Input/output control method:** Scan synchronization batch processing system (direct input/output functions)

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APPLICATION MODULE

Conveyor Control Simulation Unit

The belt conveyor is an endless belt moving over two end pulleys at fixed positions and used for transporting material horizontally or at an incline up or down.

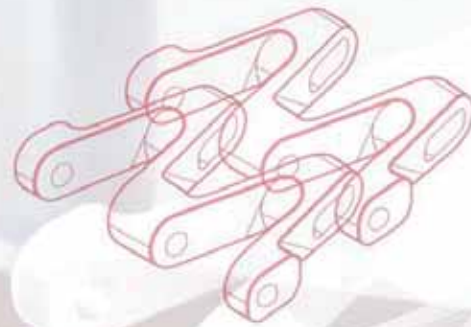
The main components of a belt conveyor are: Belt, Idlers, Pulleys, Drive, and the Structure that supports and maintains the alignments of the idlers and pulleys and support the driving machinery.

Capable of counting moving object by application of Photo Sensors.

Capable of detecting size deviation of moving objects by suitable positioning of Photo Sensors.

Capable of distributing the objects as per their size and can change the direction of moving objects.

Conveyor Simulator Unit can be controlled manually or automatic by PLC.



KEY SPECIFICATIONS:

SPECIFICATIONS

- Input Power: AC 220V 50/60Hz
- Conveyor Belt Size: 60(W) × 570 (L) mm
- Movable Speed: 4 RPM (Deceleration Gear)
- Condition of Rejection: 2 positions
- Operating Mode: Manual and Auto by PLC
- Presentable Compare: 2 Digit Count
- Dimensions: 680 (W) × 130 (H) × 310 (D) mm
- Control Output: 13 points
- Weight: 11 Kg

APPLICATION

- Assembly line automation
- Chip handling
- Recycling system
- Tire wheel handling system
- Bulk material conveyor
- Scrap metal handling
- Parts handling conveyors

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