

RAMCO INSTITUTE OF TECHNOLOGY

*DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING*

ELECTRO-TECHNOMANIA!

**ACADEMIC YEAR
2024-2025**

Technical Magazine



RAMCO INSTITUTE OF TECHNOLOGY

Approved by AICTE, New Delhi & Affiliated to Anna University

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NBA Accredited UG Programs: CSE, EEE, ECE and MECH

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About Ramco Institute of Technology



Ramco Institute of Technology is founded with a vision to impart high quality engineering education at an affordable cost. Under the able guidance of our **Chairman Shri. P. R. Venketrama Raja**, son of **Shri P. R. Ramasubrahmaneya Rajha**; distinguished professionals, academicians and education experts, we continually aim to revolutionize the learning environment by creating an enviable knowledge pool of engineering and technology graduates who are attuned to the current industry requirements.

Being part of the Ramco Group, which is well known for its qualitative and innovative brands not only in India but across the world, we are looked upon to set high standards in the education sector. True to its legacy, RIT has embarked on a mission to empower students with high-quality, accessible yet world-class engineering education and prepare these young minds for lifelong learning by creating and disseminating appropriate knowledge

Department of Electrical and Electronics Engineering

- The Department of Electrical and Electronics Engineering is established in the year 2013. Currently, it offers a 4 year Under-Graduate programme, B.E. Electrical and Electronics Engineering with a sanctioned intake of 60.
- The objective of the Department is to impart quality education and competitive training that will transform Students into Professional Engineers who are prepared to meet the needs of the society and adapt to the rapidly changing technology in various areas of Electrical and Electronics Engineering.
- The Department has well-qualified and experienced Faculty members with specialization in Power Systems, High Voltage Engineering, Power Electronics and Control Systems. The Faculty members also have wide experience in teaching. They have a strong sense of responsibility to provide the finest possible engineering education to the students.
- The Department has dedicated and state-of-the-art laboratories and leading softwares like DIGSILENT Lab VIEW Academy, ETAP, MATLAB, PLC/SCADA and Power World Simulator to cater to academic and research activities. It provides the Students with an in-depth knowledge in fundamentals and practical applications, so that he/she can pursue for wide-range of career opportunities.
- The Department conducts Workshops, Seminars and Conferences and invites renowned academicians and industrial experts to enable the Students and Faculty to update with the latest developments. It also encourages Students to interact with Experts from Industries and other prominent Institutions.

Vision, Mission, PEOs & PSOs

Vision

- To create competent electrical and electronics engineers with professional and research skills, and a sense of ethics to meet the demands of multidisciplinary challenges and a technologically advancing society.

Mission

- Empowering the students with up-to-date knowledge and technological skills in Electrical and Electronics Engineering thrust areas.
- Providing a rigorous practical training through industrial collaboration to produce Electrical and Electronics Engineers with good design experience.
- Adopting effective teaching learning methodologies and value added courses to create Electrical and Electronics Engineers with a strong fundamental knowledge.
- Enabling the students to be life-long learners to meet intellectual, ethical and career challenges.

Program Educational Objectives (PEOs)

- Graduates will pursue their careers in diversified sectors of the industry, higher education in their fields of interest and/or emerge as entrepreneurs.
- Graduates will design, manufacture, and/or maintain systems in the field of electrical and electronics engineering and allied engineering industries.
- Graduates will work effectively as individuals and as team members in multidisciplinary projects with leadership qualities, social and ethical responsibilities.

Program Specific Outcomes (PSOs)

- **PSO1:** Analyse the performance of electrical and electronic systems using modern software packages.
- **PSO2:** Specify, design, prototype and test electronic systems and embedded systems in various engineering applications.
- **PSO3:** Design and develop the hardware and software required for industrial automation systems.

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ESP - 32 In Automation

- The **ESP32** is a 32-bit microcontroller developed by **Espressif Systems** and is widely used in automation due to its high performance, integrated wireless connectivity, and low cost. It is based on the **Tensilica Xtensa dual-core processor** and operates at clock speeds of up to **240 MHz**.
- The ESP32 includes **built-in Wi-Fi (802.11 b/g/n)** and **Bluetooth (Classic and BLE)**, enabling wireless communication in automated systems. It supports multiple communication protocols such as **UART, SPI, I²C, CAN (via external controller), and PWM**, making it suitable for interfacing with sensors and actuators.
- In automation, the ESP32 functions as a **control and monitoring unit**. It reads data from sensors such as temperature, current, voltage, pressure, and motion sensors, processes the data, and controls devices like relays, motors, and solenoid valves. Its support for **FreeRTOS** allows real-time task scheduling and multitasking.
- ESP32 is commonly used in **industrial automation, home automation, and energy management systems**. Typical applications include smart lighting, motor control, remote monitoring, data logging, smart meters, and IoT-based control systems. Cloud communication is achieved using protocols such as **MQTT and HTTP**.

ESP - 32 In Automation

- The ESP32 features **multiple GPIO pins, 12-bit ADC, DAC outputs, low-power sleep modes, and over-the-air (OTA) firmware updates.** These features enable reliable operation in both wired and wireless automation environments.
- Due to its **compact size, low power consumption, and affordability,** the ESP32 is widely adopted in modern automation systems, especially in IoT-based and smart control applications.

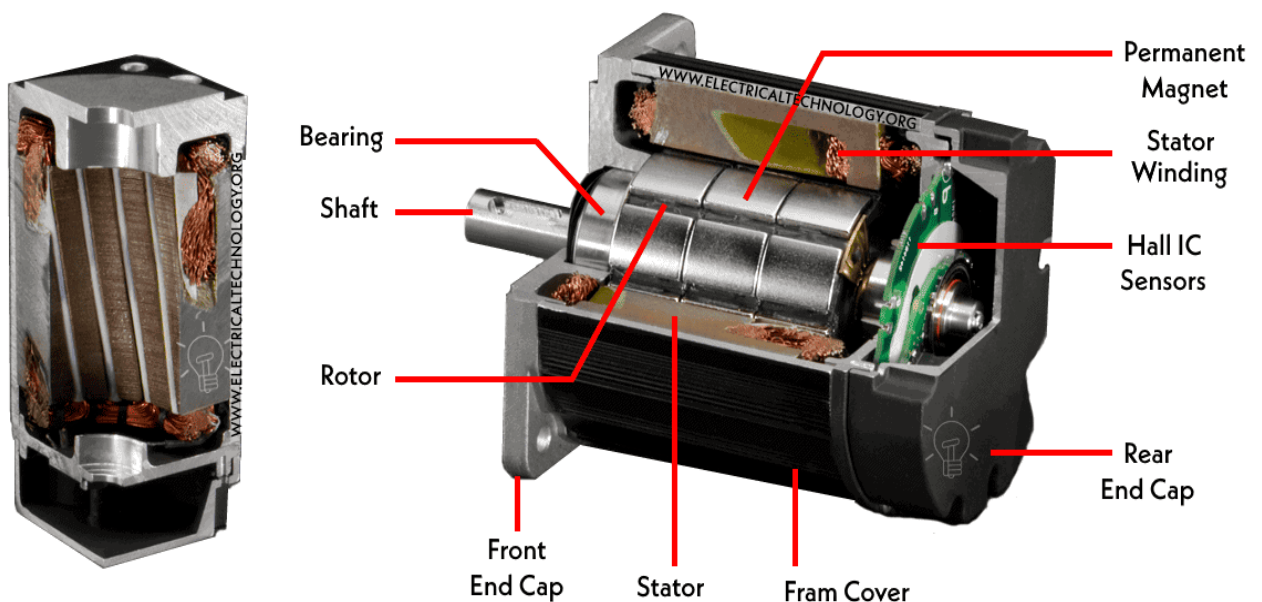


BLDC Motor Control for EV Projects

- A **BLDC (Brushless DC) motor** is widely used in **electric vehicle (EV) projects** due to its high efficiency, high torque-to-weight ratio, and long operational life. Unlike brushed motors, BLDC motors use **electronic commutation** instead of mechanical brushes, which reduces wear and increases reliability.
- BLDC motor control in EVs is performed using a **motor controller (Electronic Speed Controller – ESC)**. The controller converts the **DC supply from the battery** into **three-phase AC signals** required to drive the motor. This is done using a **three-phase inverter circuit** consisting of MOSFETs or IGBTs.
- Motor position is detected using **Hall-effect sensors** or **sensor less back-EMF detection**. Based on rotor position, the controller switches the inverter transistors in a specific sequence to maintain continuous rotation. This process is called **electronic commutation**.
- The speed of a BLDC motor is controlled by **Pulse Width Modulation (PWM)**, which adjusts the voltage applied to the motor. Higher PWM duty cycle increases speed, while a lower duty cycle reduces it. Torque is controlled by regulating the **current supplied to the motor**.

BLDC Motor Control for EV Projects

- In EV projects, BLDC motor controllers also manage:
 - **Acceleration and braking**
 - **Regenerative braking**
 - **Battery current limits**
 - **Thermal protection**
- Feedback from **current sensors, voltage sensors, and temperature sensors** ensures safe and efficient operation. Regenerative braking allows the motor to act as a generator during deceleration, returning energy to the battery.
- BLDC motor control systems in EVs improve **energy efficiency, driving range, and performance**, making them a key technology in modern electric vehicle design.



Microchips in Smartphones

A microchip is a small silicon - based electronic circuit. It works as the “Brain” of a smartphone. It controls processing, memory, communication, and power usage.

It is created on silicon wafers using nanotechnology. Billions of transistors are patterned using photolithography. Smaller transistor sizes (like 5nm, 3nm) make chips faster and more power-efficient.

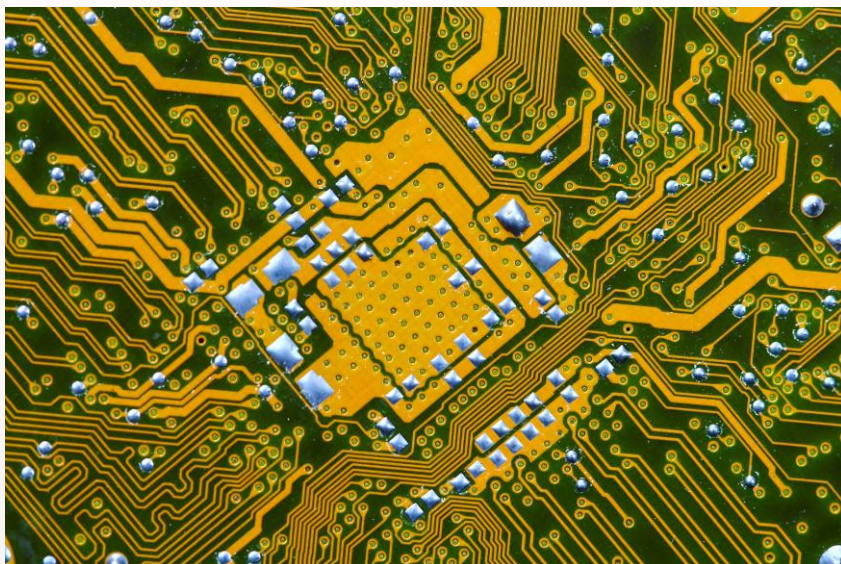
Key Components

1. Central Processing Unit (CPU):

- It is core of the Mobile which performs various operations and calculations to handle tasks such as running applications, performing system operations.
- CPUs with Multi – Core can extend its usability by being faster and reliable on its performance.

2. Graphics Processing Unit (GPU):

- Sole Purpose of Rendering Images, Videos, Animations and other Resource Intensive Tasks.
- Essential for Camera Processing, UI Graphics and Gaming.



Microchips in Smartphones



3. Memory Units (RAM + ROM):

- Technology trends keeps increasing with the Data Transfer speeds of RAM and the Memory Storage provided by ROM for Smartphones.

4. NPU / AI Engine:

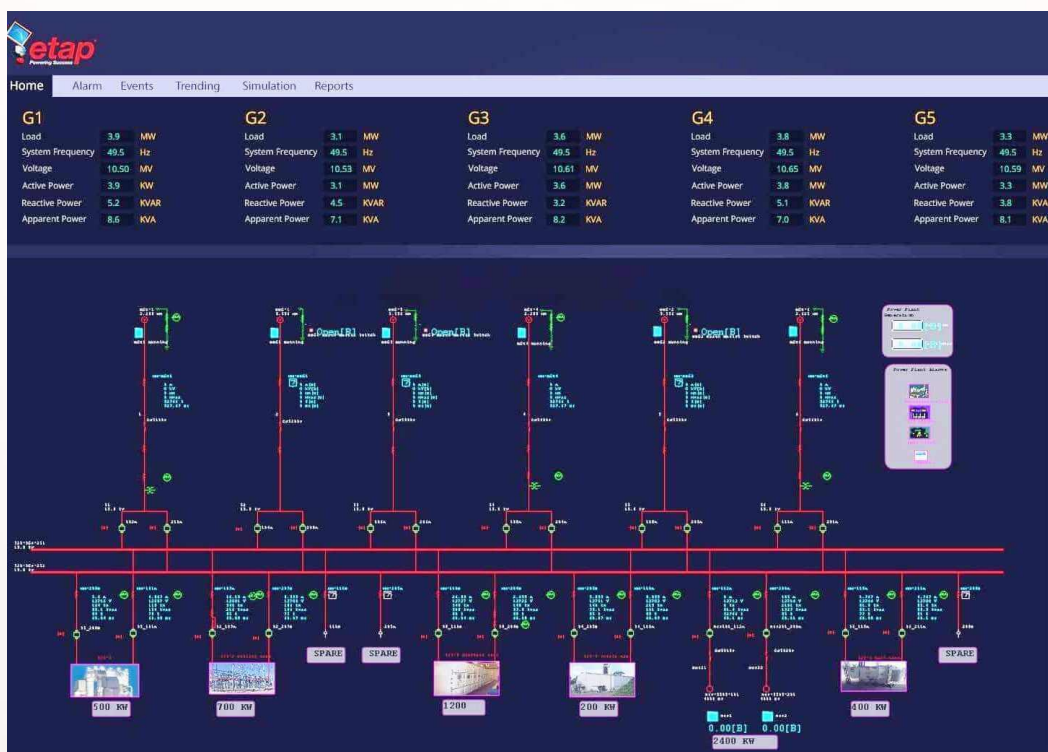
- In Recent light, AI is used in almost all services that are provided in a Smartphone for better User Experience.
- Such AI Use Cases are Face Recognition, Predictive Text, and Camera Enhancements

SCADA for Substation Monitoring

- **SCADA (Supervisory Control and Data Acquisition)** is a computer-based system used to monitor and control **electrical substations**. It enables real-time supervision of power flow, equipment status, and fault conditions from a central control room.
- In a substation, SCADA collects data from field devices such as **current transformers (CTs), potential transformers (PTs), circuit breakers, relays, and sensors**. This data is acquired through **Remote Terminal Units (RTUs)** or **Intelligent Electronic Devices (IEDs)** installed at different points in the substation.
- The SCADA system continuously monitors important parameters such as:
 - Voltage
 - Current
 - Frequency
 - Power factor
 - Breaker status
 - Transformer temperature
- Communication between substations and the control center is carried out using **fiber optics, radio, or Ethernet networks**, following standard protocols such as **IEC 60870-5-104, DNP3, and IEC 61850**.

SCADA for Substation Monitoring

- SCADA provides operators with **real-time displays, alarms, and event logs**. If a fault occurs, such as an overload or short circuit, the system immediately raises an alarm and records the event. Operators can remotely **open or close circuit breakers**, isolate faulty sections, and restore power quickly.
- SCADA also enables **data logging and trending**, which helps in maintenance planning, load forecasting, and fault analysis. Historical data is used to identify equipment aging and abnormal operating conditions.
- By enabling **fast fault detection, remote control, and continuous monitoring**, SCADA significantly improves the **reliability, safety, and efficiency** of power substation operations.

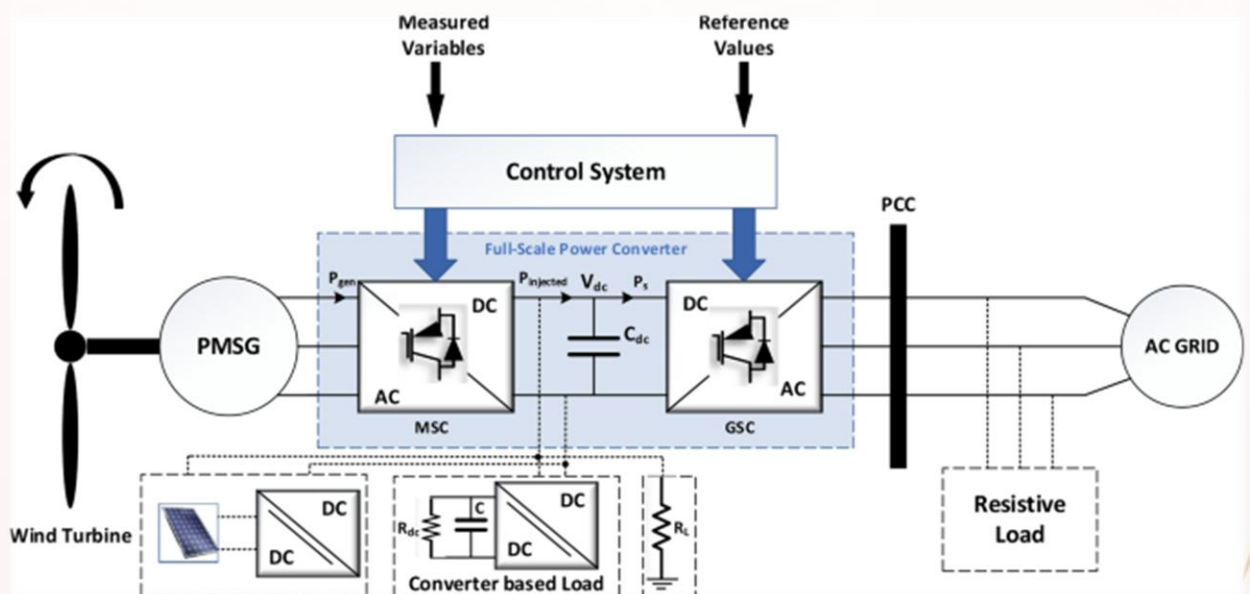


Wind Turbine AC vs DC

- Wind turbines generate electrical power by converting the **rotational energy of wind** into electrical energy using a **generator**. The type of electrical output produced by a wind turbine depends on the **generator and power electronics** used.
- Most wind turbines generate **AC (Alternating Current)** at the generator. This AC is typically **variable in voltage and frequency** because wind speed changes constantly, causing the turbine speed to vary. Common generators used are **induction generators** and **permanent magnet synchronous generators (PMSG)**.
- In grid-connected wind turbines, the variable AC output from the generator cannot be directly supplied to the power grid. It is first sent to a **rectifier**, which converts the AC into **DC**. This DC is then processed by a **DC link** and passed through an **inverter**, which converts it back into **fixed-frequency AC** that matches the grid (50 Hz or 60 Hz).
- In **battery-based or off-grid wind systems**, the AC produced by the generator is usually converted into **DC** and used to **charge batteries**. The stored DC power can later be converted into AC using an inverter for running appliances.
- Some small wind turbines use **DC generators** or PMSGs with built-in rectifiers that provide **DC output directly**. These are commonly used in **standalone charging systems** and hybrid renewable energy setups.

Wind Turbine AC vs DC

- In summary:
- Wind turbine generators produce **AC power** naturally.
- **Rectifiers convert AC to DC** for storage or control.
- **Inverters convert DC back to AC** for grid or load supply.
- This AC–DC–AC conversion allows wind turbines to provide **stable, usable power** despite changing wind speeds.



Facial Recognition

- **Facial recognition** is a biometric technology used to identify or verify a person by analyzing their facial features. It is based on **computer vision** and **artificial intelligence (AI)**, particularly **deep learning algorithms**.
- A facial recognition system works by first capturing an image or video of a face using a **camera**. The system then detects the face and extracts key features such as the **distance between the eyes, shape of the nose, jawline, and facial contours**. These features are converted into a **numerical representation called a face template**.
- The generated face template is compared with templates stored in a **database**. If a close match is found, the person is identified or authenticated. This process is known as **face matching**. Modern systems use **Convolutional Neural Networks (CNNs)** to improve accuracy.
- Facial recognition systems can operate in:
 - **1:1 mode** (verification), such as unlocking a phone
 - **1:N mode** (identification), such as surveillance systems
- The technology is widely used in:
 - Smartphone and laptop security
 - Airport and border control
 - Attendance systems
 - Banking and payment verification
 - Law enforcement and surveillance

Facial Recognition

- Facial recognition systems rely on factors such as **image quality, lighting, camera resolution, and viewing angle**. High-quality cameras and AI models improve recognition accuracy.
- Key components of a facial recognition system include:
 - Camera or image sensor
 - Face detection software
 - Feature extraction algorithm
 - Face database
 - Matching and decision system
- Facial recognition provides **fast, contactless, and automated identity verification**, making it a major technology in modern digital security systems.

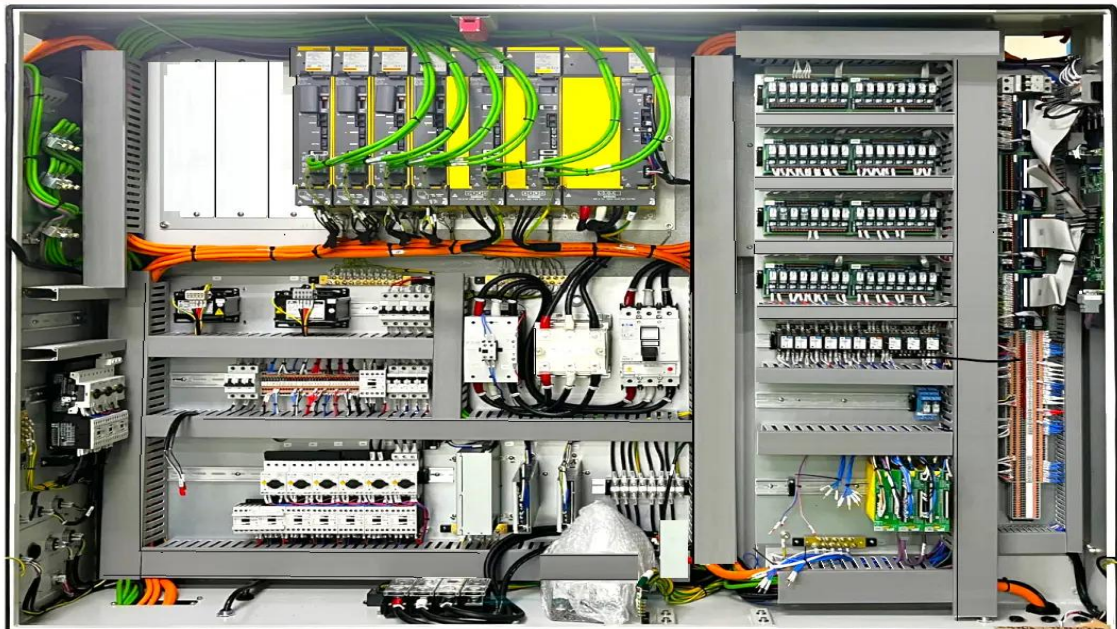


PLC in Industrial Automation

- A **PLC (Programmable Logic Controller)** is a specialized industrial computer used to control machines and processes in **industrial automation**. It is designed to operate reliably in harsh environments such as factories, power plants, and process industries.
- A PLC consists of three main parts: **CPU, input modules, and output modules**. The **input modules** receive signals from devices such as switches, sensors, limit switches, and proximity sensors. The **CPU** processes these signals according to a stored program. The **output modules** control devices such as motors, relays, valves, and indicator lamps.
- PLCs are programmed using languages defined in the **IEC 61131-3 standard**, including **Ladder Logic, Function Block Diagram, and Structured Text**. Ladder Logic is the most commonly used language because it resembles electrical control circuits.
- In industrial automation, PLCs perform functions such as:
 - Machine control
 - Conveyor and motor control
 - Temperature and pressure control
 - Process sequencing
 - Safety interlocking

PLC in Industrial Automation

- PLCs operate in a continuous cycle called the **scan cycle**, which includes reading inputs, executing the program, and updating outputs. This allows real-time control of industrial equipment.
- PLCs communicate with other devices using industrial protocols such as **Modbus, Profibus, Profinet, Ethernet/IP, and CAN**. They can also be connected to **SCADA and HMI systems** for monitoring and operator control.
- Due to their **high reliability, fast response, and easy reprogramming**, PLCs are widely used in manufacturing plants, power stations, chemical industries, and automated production lines.

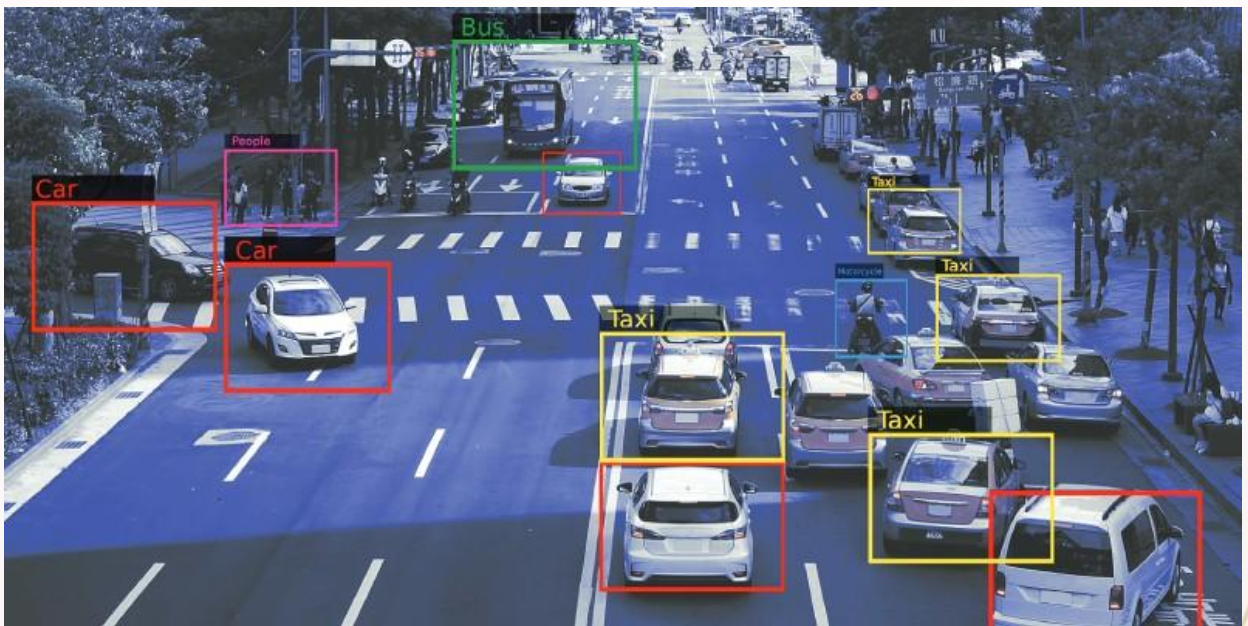


Smart Traffic Systems

- A **Smart Traffic System** is an intelligent transportation system that uses **sensors, cameras, communication networks, and software** to monitor and control traffic flow in real time. It is designed to reduce congestion, improve road safety, and optimize the use of road infrastructure.
- Smart traffic systems collect data using **traffic cameras, infrared sensors, radar sensors, inductive loop detectors, and GPS data** from vehicles. This data is processed by a **central control system** or cloud-based platform to analyze traffic density, vehicle speed, and road conditions.
- Based on real-time traffic data, **traffic signal controllers** automatically adjust signal timings. For example, green light duration is increased on busy roads and reduced on low-traffic lanes. This dynamic control reduces waiting time and fuel consumption.
- Smart traffic systems also support:
 - **Emergency vehicle priority**
 - **Accident and congestion detection**
 - **Automatic number plate recognition (ANPR)**
 - **Violation monitoring**
 - **Real-time traffic information to users**

Smart Traffic Systems

- Communication technologies such as **fiber optics, 4G/5G, IoT, and V2I (Vehicle-to-Infrastructure)** are used to exchange data between vehicles, traffic signals, and control centers.
- Smart traffic systems improve **traffic efficiency, road safety, and environmental sustainability**, making them an essential part of modern smart city infrastructure.





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