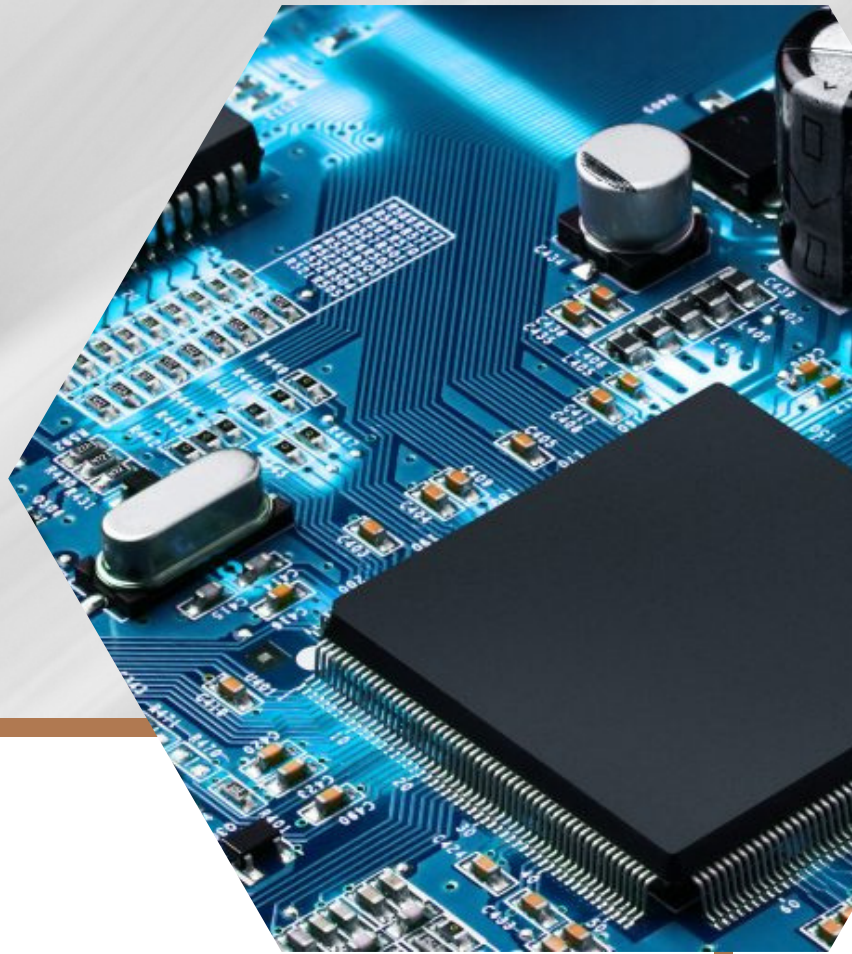


# EMBEDDED SYSTEMS TRAINING

TRAFFIC LIGHT CONTROLLER



**Name:**

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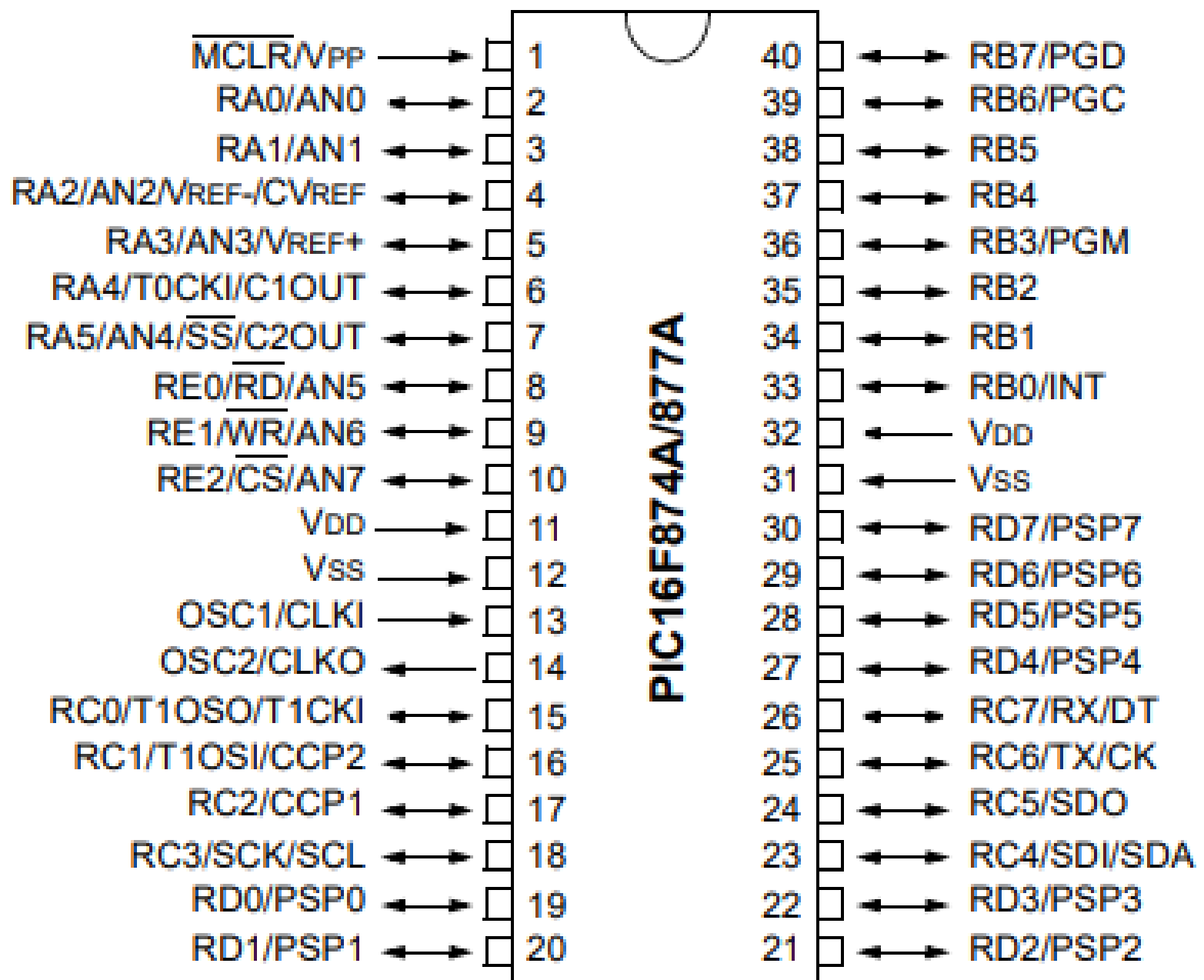
# what are Emedded Systems ?

An embedded system is a computer system that is designed to perform a specific task, in contrast to general-purpose computers designed for multiple tasks. Embedded systems are often found in everyday devices.

## What are Embedded Systems Applications?

- Traffic Light
- Digital cameras
- Smart watch
- TV remote control
- Microwave ovens
- Medical devices
- etc..

# PIC16f877A of Microchip:



The **PIC16F877A** is a **40-pin** microcontroller that has five ports: Port A, Port B, Port C, Port D, and Port E.

Port A has 6 pins, from RA0 to RA5. These pins can be used as digital input or output pins, and they can also be used for analog-to-digital conversion (ADC).

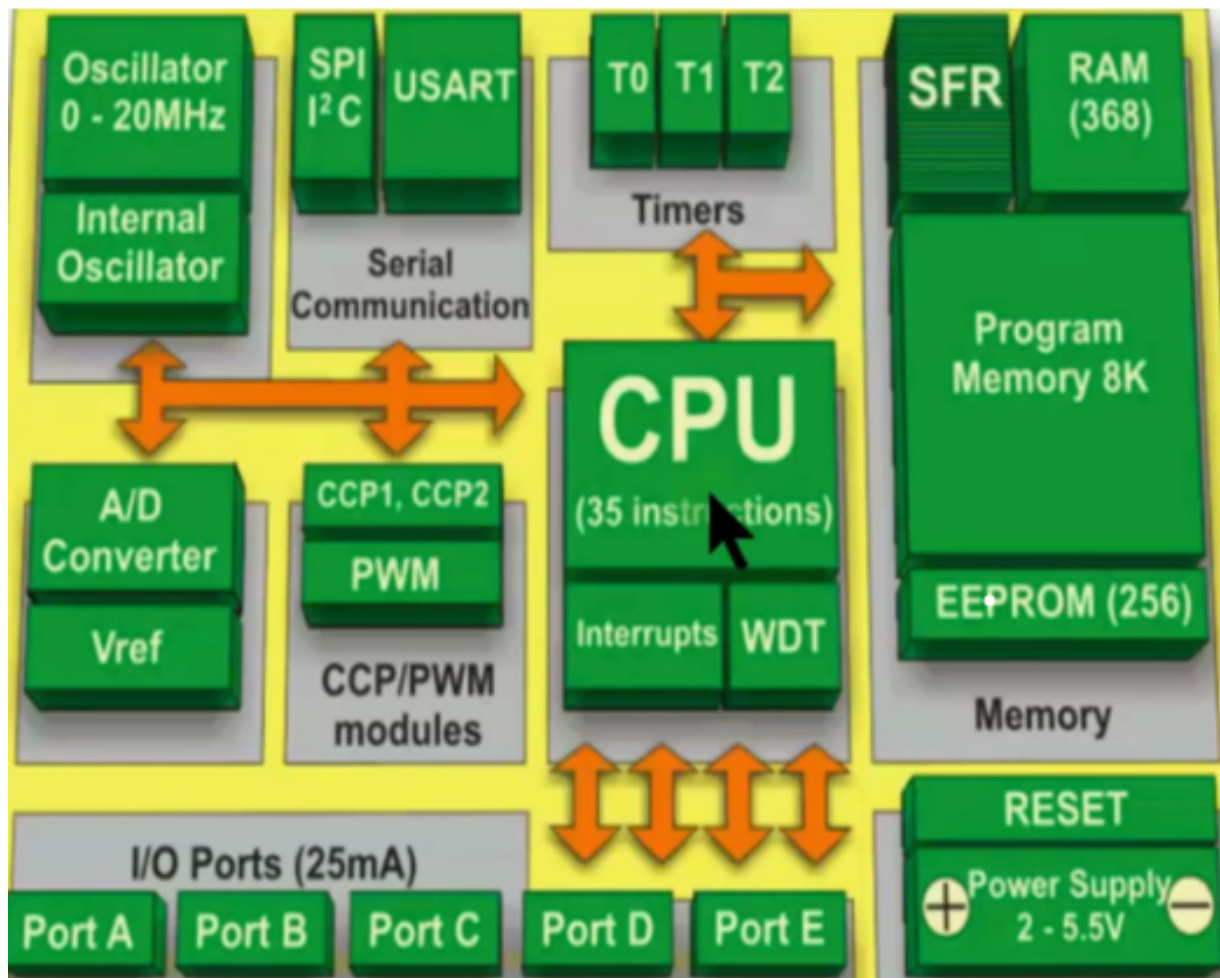
Port B has 8 pins, from RB0 to RB7. These pins can be used as digital input or output pins, and they can also be used for some special functions, such as the Reset pin (RB3/PGM) and the Programming Clock (RB6/PGC) and Programming Data (RB7/PGD).

Port C has 8 pins, but only 6 of them are accessible from the outside. These pins can be used as digital input or output pins, and they can also be used for some special functions, such as the Serial Data Input (RC6) and Serial Data Output (RC7) pins.

Port D has 8 pins, all of which are accessible from the outside. These pins can be used as digital input or output pins, and they can also be used for some special functions, such as the Timer 0 External Input (T0CKI) pin and the Timer 1 External Input (T1CKI) pin.

Port E has 3 pins, all of which are accessible from the outside. These pins can be used as digital input or output pins, and they can also be used for some special functions, such as the External Interrupt (INT) pin and the Reset Enable (RE3) pin.

The **PIC16F877A** is a microcontroller that has a number of different blocks, each of which performs a specific function.



### Arithmetic Logic Unit (ALU):

The ALU is the part of the microcontroller that performs mathematical and logical operations. It can add, subtract, multiply, and divide numbers, and it can also perform logical operations such as AND, OR, and XOR.

### Status and Control :

The status and control block contains a number of registers that store the status of the microcontroller and control its operation. These registers include the carry flag, the zero flag, the overflow flag, and the interrupt flag.

### **Program Counter (PC):**

The program counter is a register that stores the address of the next instruction to be executed. The PC is incremented automatically by the microcontroller as each instruction is executed.

### **Flash Program Memory :**

The flash program memory is where the program code for the microcontroller is stored. The flash program memory is non-volatile, which means that the program code is stored even when the power is turned off.

### **Instruction Register (IR):**

The instruction register stores the current instruction that is being executed. The IR is loaded from the flash program memory by the PC.

### **Instruction Decoder :**

The instruction decoder decodes the instruction in the IR and generates the control signals that are needed to execute the instruction. The instruction decoder also determines the type of instruction that is being executed and sets the appropriate flags in the status and control block.



The **ATMega328P** and **PIC16F877A** are both 8-bit microcontrollers, but they have different characteristics



### Memory size:

The ATMega328P has 32 KB of flash program memory, compared to the PIC16F877A's 8 KB. It also has 2 KB of SRAM, compared to the PIC16F877A's 1 KB. This means that the ATMega328P can store more code and data, which makes it a better choice for more complex applications.

### Power consumption:

The ATMega328P has a lower power consumption than the PIC16F877A. This is because it uses a Harvard architecture, which means that the program memory and data memory are separate. This allows the ATMega328P to access program memory and data memory simultaneously, which reduces power consumption.

## **Pin count:**

The ATmega328P has 23 general-purpose I/O pins, compared to the PIC16F877A's 14. This means that the ATmega328P can be used to interface with more peripherals, which makes it a better choice for applications that require a lot of I/O.

**Examples** of embedded systems where ATmega328P is a better choice than PIC16F877A

- **Home automation:** The ATmega328P's larger memory and lower power consumption make it a better choice for home automation projects. For example, it could be used to control a smart home system or a security system.
- **IoT devices:** The ATmega328P's small size and low power consumption make it a good choice for IoT devices. For example, it could be used to create a wireless sensor network or a wearable device.

In general, the ATmega328P is a better choice than the PIC16F877A for applications that require more memory, lower power consumption, or more I/O pins.