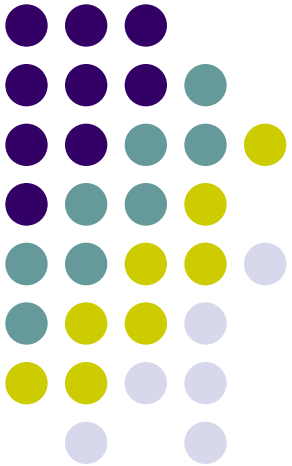
Chapter 1: Embedded Systems and Microcontrollers

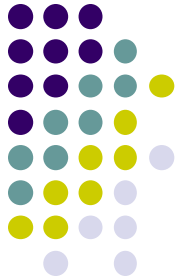
EE2405

嵌入式系統與實驗

Embedded System Lab



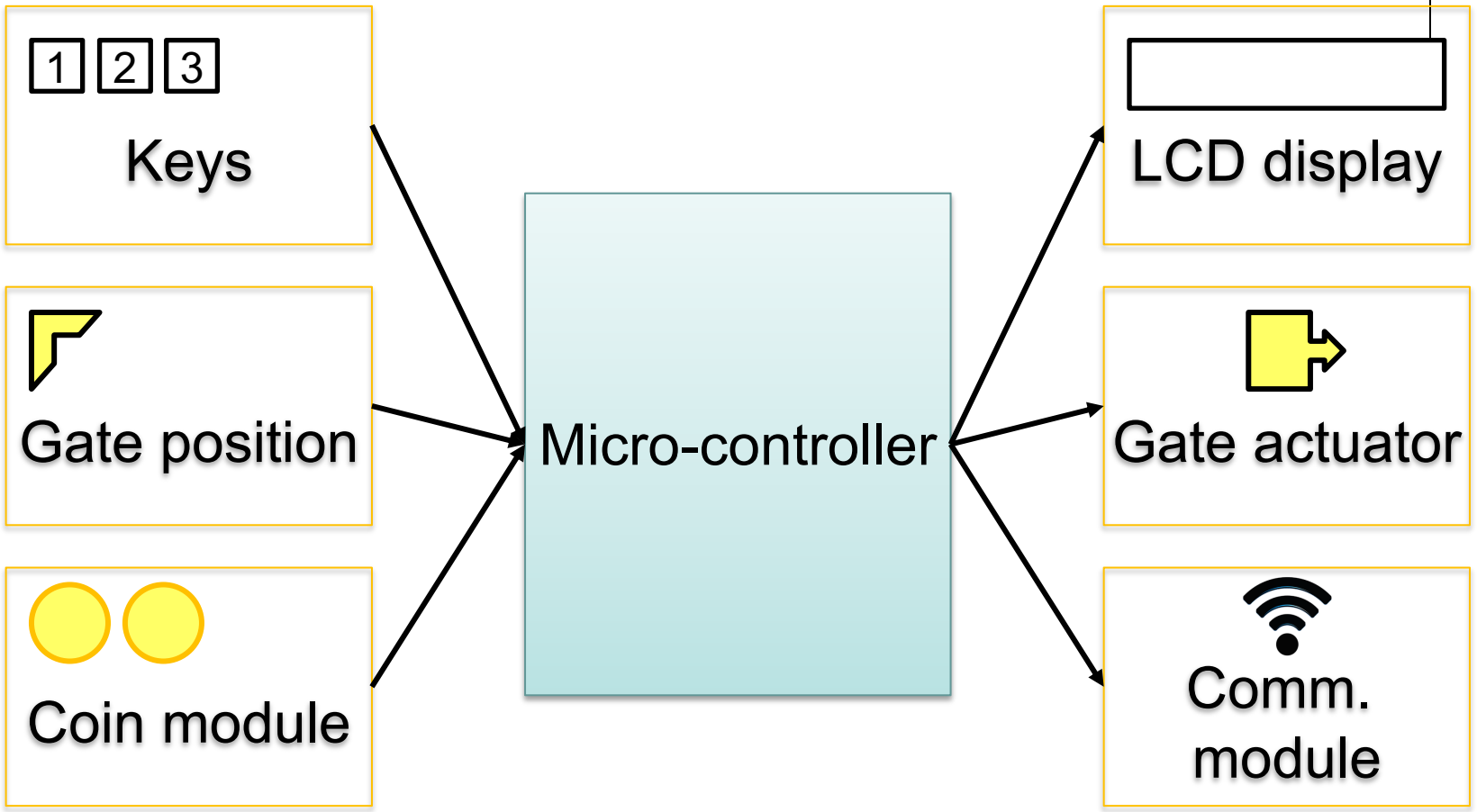
What is an Embedded System



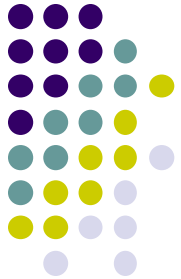
- An embedded system is a product which is controlled by a computer inside it, but whose overall function is not computing.
- Examples are near endless, and include washing machines, office equipment, and car engine management.

An example: vending machine

- At its heart is a microcontroller.
- It accepts a number of input signals: the user keypad, the coin counting module, and from the dispensing mechanism itself.
- If enough money is provided and selected item is available, the controller will trigger delivering mechanism.

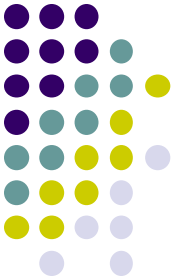

1 2 3
Keys
Gate position
Coin module
Micro-controller
LCD display
Gate actuator
Comm. module

Micro-controller

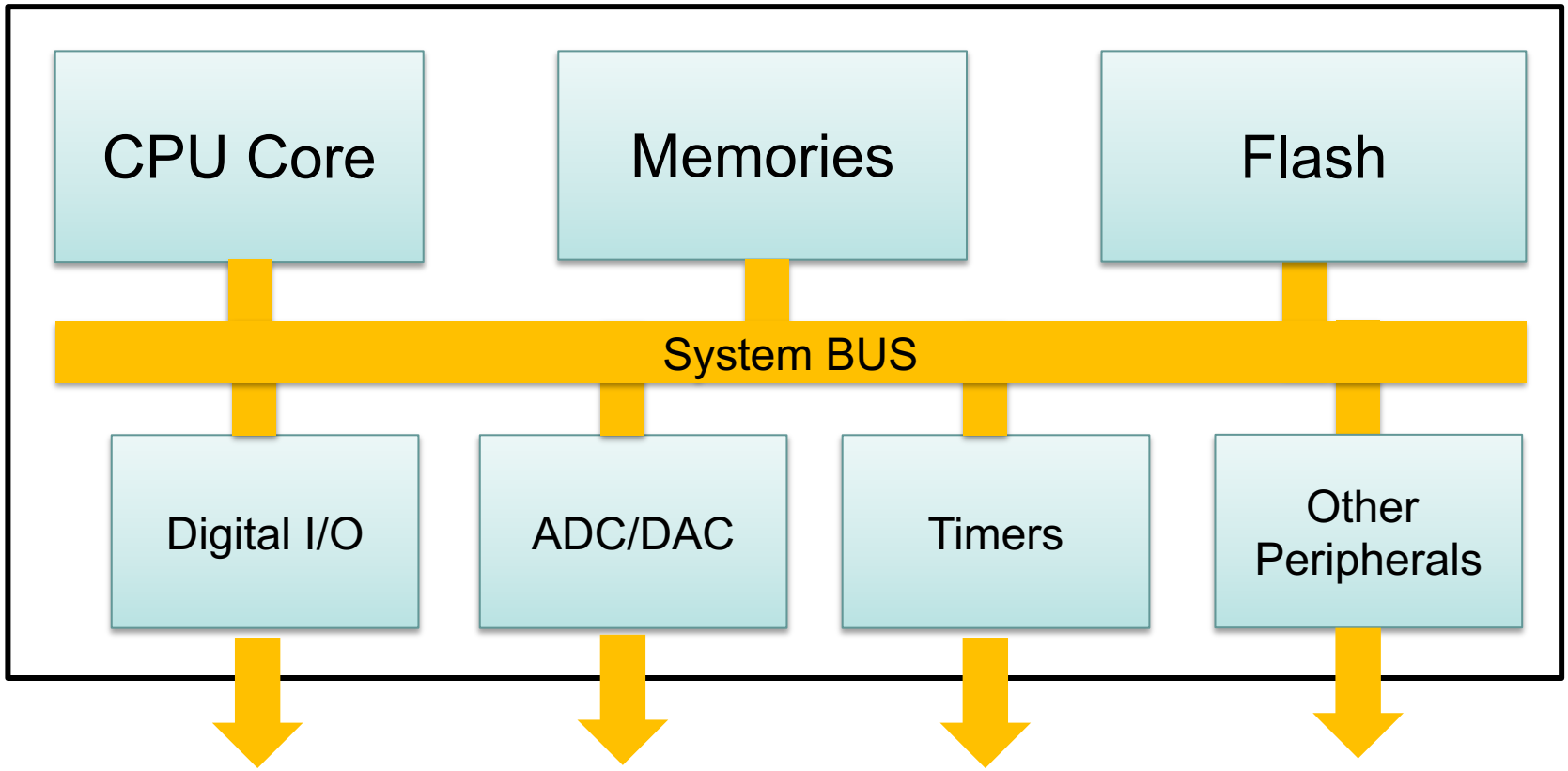


- A micro-controller is a *Central Processing Unit* (CPU), which takes and decodes instructions, and output calculated results to memory or output ports.

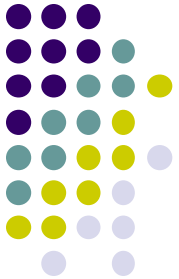
A Typical Processor-based System



- Core, memory and peripherals



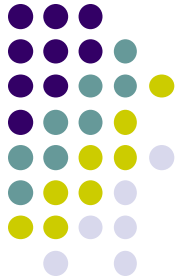
I/O Peripherals



- A micro-controller controls its peripherals by accessing registers on peripherals blocks.
- Peripheral register is assigned with a unique address.
  - In the same memory address space.

- Peripheral may include:
  - Digital I/O
  - Timers
  - Analog to digital converter (ADC)
  - Digital to analog converter (DAC)
  - Communication interfaces (WiFi, Bluetooth, USB, etc.)

Chapter Review



- An embedded system contains one or more tiny computers, which control it, and give it a sense of intelligence.
- The embedded computer usually takes the form of a microcontroller, which combines CPU core, memory and peripherals.
- Embedded system design combines hardware (electronic, electrical and electro-mechanical) and software (program) design.
- The embedded microcontroller has an instruction set. It is the ultimate goal of the programmer to develop code which is made up of instructions from this instruction set.
- Most programming is done in a high level language, with a compiler being used to convert that program into the binary code, drawn from the instruction set and recognized by the microcontroller.