Embedded Systems
Module 2

Characteristics of Embedded Systems

Objectives

1. Highlight the characteristics of embedded systems.
2. Describe the different types of embedded systems.

Characteristics

All Embedded Systems are task specific. They do the same task **repeatedly /continuously** over their lifetime.

Example :An mp3 player will function only as an mp3 player.

Embedded systems are created to perform the task within a certain time frame. It must therefore perform fast enough. A car’s brake system, if exceeds the time limit, may cause accidents.

What is MTBF?

Characteristics

MTBF stands for Mean Time Between Failures. It is a metric used to estimate the reliability of a system or a component. MTBF represents the average time that elapses between two consecutive failures of a system or a component during normal operation.

MTBF is often used in various industries, including engineering, manufacturing, and information technology, to assess the reliability and availability of systems. It is typically measured in units of time, such as hours, days, or years, depending on the application.

Sample link to find info about MTF :
https://www.ti.com/quality/docs/estimator.tsp

Characteristics

They have minimal or no user interface (UI).

•A fully automatic washing machine works on its own after the program is set and stops once the task is over.

•Some embedded systems are designed to react accordingly.

A thermometer,

a GPS tracking device.

Characteristics

- Embedded systems are built to achieve certain efficiency levels.
- They are small sized, can work with less power and are not too expensive.

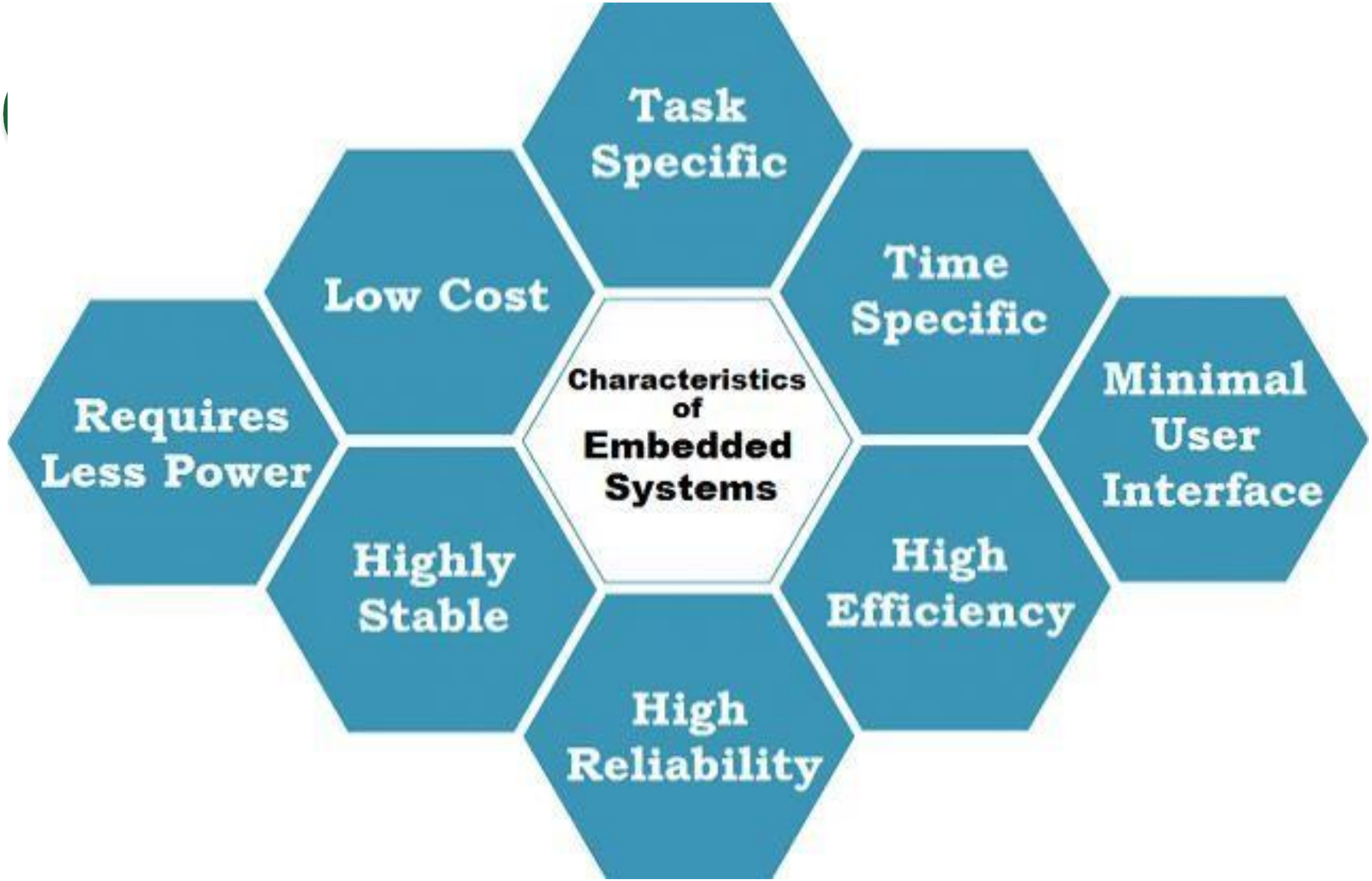
- Embedded systems **cannot be changed or upgraded by the users**. Hence, they must rank high on reliability and stability. They are expected to function for **long durations without the user experiencing any difficulties.**

Characteristics

- Microcontroller and microprocessors are used to design embedded systems.

- Embedded systems need connected peripherals to attach input & output devices.

- The hardware of an embedded-system is used for security and performance. The Software is used for features.


Task Specific
Low Cost
Time Specific
Requires Less Power
Characteristics of Embedded Systems
Minimal User Interface
Highly Stable
High Efficiency
High Reliability

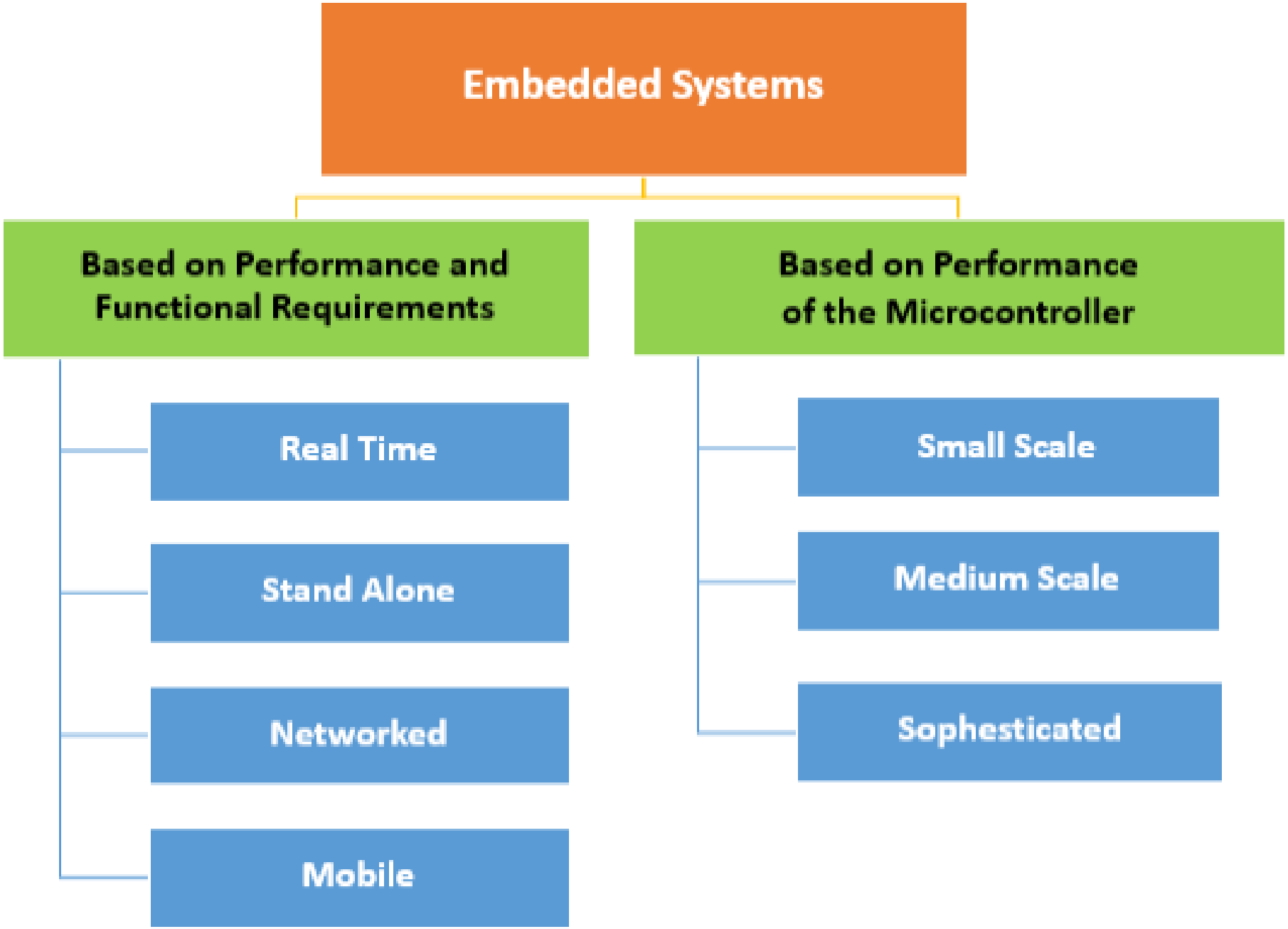
Types of Embedded Systems

Types

Types of Embedded System

Embedded systems can be classified based on:

- Performance and Functional requirements
- Performance of the Microcontroller


Embedded Systems
Based on Performance and Functional Requirements
Based on Performance of the Microcontroller
Real Time
Stand Alone
Networked
Mobile
Small Scale
Medium Scale
Sophesticated

Types

Performance and Functional Requirement Based Embedded Systems

Embedded Systems can be classified into four types based on the performance and functional requirement.

Types

- Real Time Embedded Systems
- Stand-Alone Embedded Systems
- Networked Embedded Systems
- Mobile Embedded Systems

Types

Real Time Embedded Systems

A Real Time Embedded System provides output within a defined specific time. That is, real time embedded systems are designed and created to perform some specific work in pre-specified time.

Types

Types of Real Time Embedded Systems

There are two types of Real Time Embedded System. They are:

- Soft Real Time Embedded Systems
  Example : Telecommunications

- Hard Real Time Embedded Systems
  Example :Automotive and Medical

?

Types

Stand Alone Embedded Systems

Stand-Alone Embedded Systems are those that can work by themselves i.e. they are self-sufficient and do not depend on a host system.

Stand-alone embedded systems are made in a way such that an input is received, processed and thereafter the desired output is produces.

Input can be received via sensors, keyword or push button.

Types

Networked Embedded Systems

Networked Embedded Systems depend on connected network to perform its assigned tasks.

These systems consist of components like sensors, controllers etc. which are interconnected. Many of these systems are built on general purpose processors.

Types

Mobile Embedded Systems

Mobile Embedded Systems are those that are small sized and can be used in smaller devices.

They are used in mobile phones and digital cameras because of the small size. They often have memory constraints and lacks good user interface.

Types

Microcontroller Performance Based Embedded System

Embedded System are classified in three types based on its microcontroller performance.

- Small Scale Embedded Systems
- Medium Scale Embedded Systems
- Sophisticated Embedded Systems

Types

Small Scale Embedded System

Small Scale Embedded System is normally designed and created using an 8-bit microcontroller.

This microcontroller can be battery activated.

Types

Medium Scale Embedded System

Medium Scale Embedded System uses a single 16-bit or 32-bit microcontroller or multiple microcontrollers linked together.

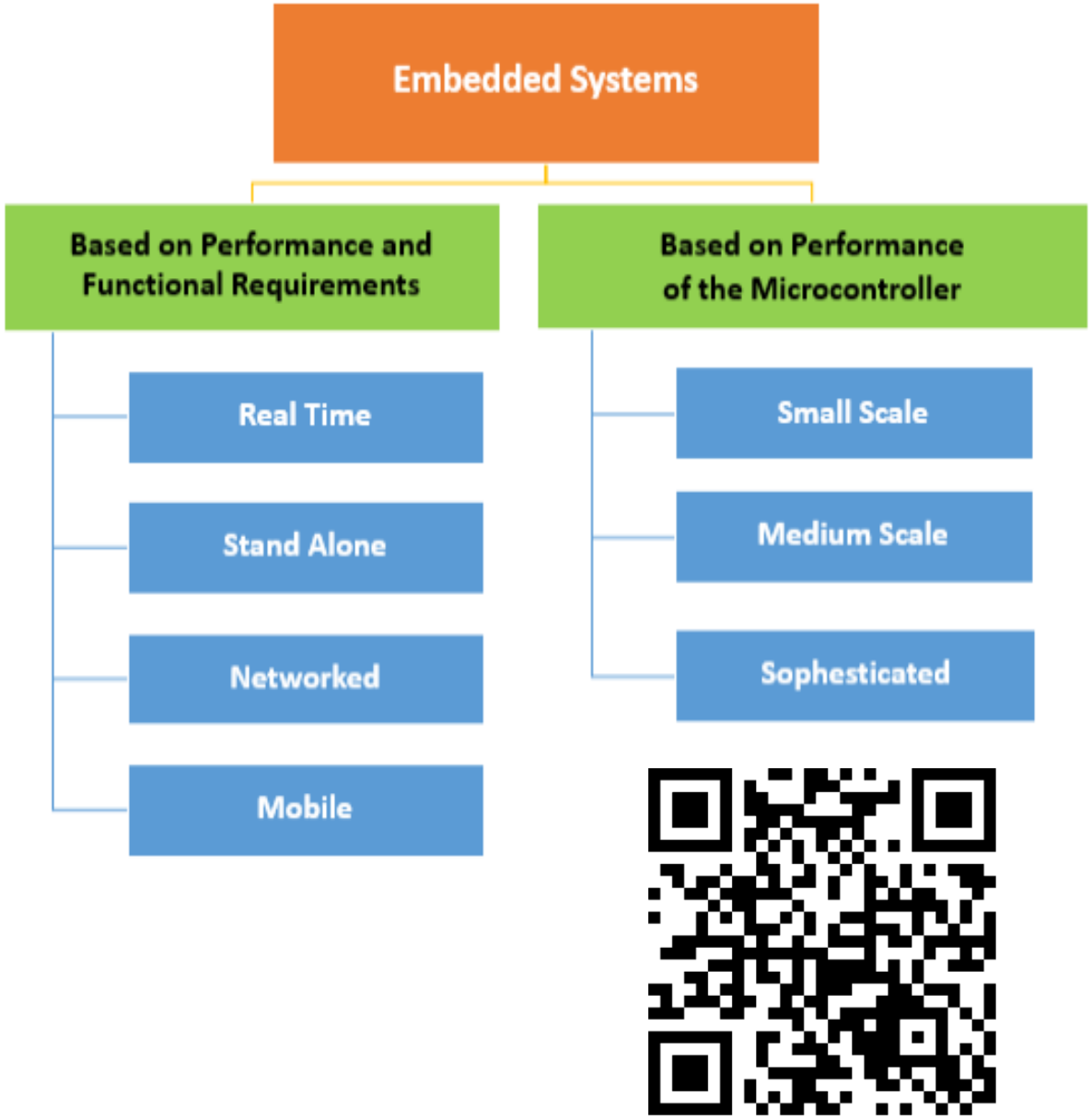
These systems have a lot of hardware as well as software complexities, hence are not preferred by many.

Types

Sophisticated Embedded System

Sophisticated Embedded System often function on multiple algorithms that results in complexities in both hardware and software.

They often need a processor that is configurable and logic array that can be programmed.



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Group Seatwork:
Min. 5 members per group

1. Name of application of the embedded system
   (i.e. Automated Irrigation System)
2. Type embedded system (i.e. Real, Stand Alone, Networked, Mobile, Small scale, med scale, sophisticated)
3. Advantages and disadvantages
4. Limitations of the application system
5. Recommendations

Thank you for listening.
End of Presentation