

Assignment - 03

MES(18CS)

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Q) what is programmable logic device (PLD)? what are the different types of PLD's ? Explain the role of PLD's in embedded system design.

→ Logic devices provide specific functions, including device to device interfacing , data communication , signal processing, data display , timing and control operations and almost every other function a system must perform.

There are 2 types of PLD's

→ Field programmable gate arrays (FPGAs)

→ Complex programmable logic devices .

Role of PLD's in embedded System design .

* programmable logic devices (PLD's) offer customers a wide range of logic capacity , features , speed and voltage characteristics and these devices can be re-configured to perform any number of functions at any time .

* Designers use inexpensive software tools to quickly develop, simulate and test their designs .

* Then , a design can be quickly programmed into device and immediately tested in a live circuit .

* There are no NRE costs and the final design is completed

much faster than that of a custom, gated logic device.

- * Another key benefit of using PLDs is that during the design phase customers can change the circuitability as often as they want until the design operates to their satisfaction.

(Q) Explain the various purpose of embedded system in detail with illustrative examples.

> (a) Data collection / storage / representation.

- * Embedded System designed for the purpose of data collection performs acquisition of data from the material world.

- * Data collection is usually done for storage, analysis, manipulation and transmission.

- * The term "data" refers all kinds of information, viz, text, voice, image, video, electrical signals and any other measurable quantities.

- * Data can be either analog or digital.

- * The collected data may be stored or transmitted or it may be processed or it may be deleted instantly after giving a meaningful representation.

Ex: A digital camera is a typical example of an embedded system with data collection.

(b) Data (signal) processing

- * A digital hearing aid is a typical example of an embedded system employing data processing.

* A digital hearing aid improves the hearing capacity of hearing impaired persons.

(1) Monitoring:

* Almost embedded products coming under the medical domain are used for monitoring.

* A very good example is the Electro Cardiogram (ECG) machine for monitoring the heartbeat of patient.

* The machine is intended to do the monitoring of the heartbeat. It cannot impose control over the heartbeat. The sensors used in ECG are the different electrodes connected to the patient's body.

(a) Some other examples of embedded systems with monitoring function are measuring instruments like digital CRO, digital millimeter, logic analyzer etc. used in control and instruction applications.

(e) An air conditioner system used to control the room temperature to a specified limit is a typical example of embedded system for control purpose.

(f) A mobile phone is an example of embedded system with an application, specific user interface.

③ Explain the sequence of operation for communicating with an I₂C slave device.

The sequence of operations for communicating with an I₂C slave device is listed below.

- * The master device pulls the clock line (SCL) of the bus to 'HIGH'.
- * The master device pulls the data line (SDA), 'LOW', when the SCL line is at logic 'HIGH'
- * The master device sends the address (7 bit or 10 bit wide) of the 'Slave' device to which it wants to communicate, over the SDA line.
 - ⇒ Clock pulses are generated at the SCL line for synchronizing the bit reception by the Slave device.
 - ⇒ The msb of the data is always transmitted first.

The data in the bus is valid during the HIGH period of the clock signal.
- * The master device sends the read or write bit (read operation; Bit value=0 write operation according to the requirement).
- * The master device waits for the acknowledgement bit from the Slave device whose address is sent on the bus along with the read/write operation command.
 - ⇒ Slave devices connected to the bus compares the address received with the address assigned to them.
- * The Slave device with the address requested by the master device responds by sending an acknowledge bit (Bit value 1) over the SDA line.
- * Upon receiving the acknowledge bit, the master device sends the 8bit data to the slave device over SDA line.

If the requested operation is "write to device".

→ If the requested operation is "read from device": the slave device, sends data to the master over the SDA line.

* The master device waits for the acknowledge bit from the device upon byte transfer complete for a write operation and sends an acknowledge bit to the slave device for a read operation.

* The master device terminates the transfer by pulling the SDA line 'HIGH' when the clock line SCL is at logic 'HIGH'.

(A) Explain quality attribute in embedded system development? what are the different quality attribute to be considered in an embedded system design.

These are the attributes that together form the deciding factor about the quality of an embedded system.

There are two types of quality attributes are:-

① operational quality attributes.

② Non-operational quality attributes.

These operational quality attributes related to operation or functioning of an embedded system. The way an embedded system operates affects its overall quality.

These operational attributes are:-

(a) Response :-

- * Response is a measure of quickness of the system.
- * It gives you an idea about how fast your system is tracking the input variables.

(b) Throughput :-

- * Throughput deals with the efficiency of system.
- * It can be defined as rate of production or process of a defined process over a stated period time.

(c) Reliability :-

- * Reliability is a measure of how much percentage you rely upon the proper functioning of the system.
- * Mean time b/w failures and mean time to repair are terms used in defining system reliability.

(d) Maintainability :-

Maintainability deals with support and maintenance to the end user or a client in case of technical issues and product failures or on the basis of a routine system checkup.

- * It can be classified into two types.

1. Scheduled or periodic maintenance: This is the maintenance that is required regularly after a periodic time interval.

Eg:- periodic cleaning of AC, Refilling of printer cartridges.

(e) Maintenance to unexpected failure.

This involves the maintenance due to a sudden breakdown in the functioning of the system.

Eg:- Air conditioners not powering on.

(f) Security:

Confidentiality, Integrity and availability are 3 other stones of information Security.

(g) Safety:

Deals with the possible damage that can happen to the operating person and environment due to the breakdown of an embedded system.

(5) Explain the different communication buses used in automotive application.

There are 3 different communication buses used in automotive application.

(a) Controller area Network (CAN):

- * CAN bus was originally proposed by Robert Bosch.
- * it supports medium speed and high speed data transfer.
- * CAN is an event driven protocol interface with support for error handling in data transmission.

(b) Local Interconnect Network (LIN):

- * LIN Bus follows the master communicating triggering to eliminate the bus ~~arbitration~~ arbitration problem.

* LIN bus application are master controls, gear controls, seat positioning controls.

(c) Media - Oriented System Transport (MOST):-

- * MOST is targeted for automotive audio / video equipment interworking.
- * MOST bus is a multimedia fiber optics point-to-point network implemented in a star, ring or daisy chained topology over optical fiber cables.
- * MOST has specifications define the physical as well as application layer, network layer and media access control.

(d) Compare the following:-

(i) C v/s embedded C

(ii) compiler v/s cross-compiler.

> (i) C v/s embedded C

* C is a well structured, well defined and standardized general purpose programming language with extensive and bit manipulation support.

* C offers a combination of the features of high level language and assembly and helps in hardware access programming as well as business package developments.

* Embedded C can be considered as a subset of a conventional 'C' language.

* Embedded C supports all 'C' instructions and incorporates

a few target processor specific functions/instructions.

(ii) Compiler vs cross-compiler

* Compiler is a software tool that converts a source - code written in a high level language on top of a particular operating system running on a specific target processor architecture.

* The operating system, the compiler program and the application making use of the source code run on the same target processor.

* Cross-compiler is the software tools used in cross-platform development applications.

* Keil C51 compiler from keil Software is an example for Cross-Compiler for 8051 family architecture.

④

Explain time to market and time to prototype, Explain its significance in product development.

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* Time to market is the time elapsed b/w the conceptualization of a product and time at which the product is ready for selling or use.

* product prototyping help in reducing time to market.

* prototyping is an informal kind of rapid product development in which important feature of the under consideration are developed.

* In order to shorten the time to prototype, make use of all possible option like use of reuse, of the self component etc.

(8) Explain with a program the mixing of assembly language with high level language.

- * Certain situations in embedded firmware development may require the mixing of assembly language with high level language or vice versa. Interrupt handling, Some code is already available in high level language (Assembly language etc are examples)
- * High level language and low level language and low level language can be mixed in three different ways.
- * Mixing assembly language with high level language like 'c'
- * Mixing high level language like 'c' with assembly language.
- * The passing of parameters and return values b/w the high level and low level languages is compiler specific.