QUALITY ATTRIBUTES OF EMBEDDED SYSTEM

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:-

•**Operational Quality Attributes**
    1. These are attributes related to operation or functioning of an embedded system. The way an embedded system operates affects its overall quality.

•**Non-Operational Quality Attributes**
    1. These are attributes **not** related to operation or functioning of an embedded system. The way an embedded system operates affects its overall quality.
    2. These are the attributes that are associated with the embedded system before it can be put in operation.

Operational Attributes

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.

•Most of the embedded system demand fast response which should be real-time

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 of time.

•In case of card reader like the ones used in buses, throughput means how much transaction the reader can perform in a minute or hour or day.

Reliability

Reliability is a measure of how much percentage you rely upon the proper functioning of the system .

Mean Time between failures and Mean Time To Repair are terms used in defining system reliability.

Mean Time between failures can be defined as the average time the system is functioning before a failure occurs.

Mean time to repair can be defined as the average time the system has spent in repairs.

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

I.   **Scheduled or Periodic Maintenance**
II. **Maintenance to unexpected failure**

Security

•Confidentiality, Integrity and Availability are three corner stones of information security.

•Confidentiality deals with protection data from unauthorized disclosure.

•Integrity gives protection from unauthorized modification.

•Availability gives protection from unauthorized user

•Certain Embedded systems have to make sure they conform to the security measures.

•Ex. An Electronic Safety Deposit Locker can be used only with a pin number like a password.

Safety

Safety deals with the possible damage that can happen to the operating person and environment due to the breakdown of an embedded system or due to the emission of hazardous materials from the embedded products.

Non Operational Attributes

Testability and Debug-ability

- It deals with how easily one can test his/her design, application and by which mean he/she can test it.
- In hardware testing the peripherals and total hardware function in designed manner
- Firmware testing is functioning in expected way
- Debug-ability is means of debugging the product as such for figuring out the probable sources that create unexpected behavior in the total system

Evolvability

For embedded system, the qualitative attribute ─Evolvability‖ refer to ease with which the embedded product can be modified to take advantage of new firmware or hardware technology.

Portability

- Portability is measured of –system Independence‖.
- An embedded product can be called portable if it is capable of performing its operation as it is intended to do in various environments irrespective of different processor and or controller and embedded operating systems.

Time to prototype and market

- Time to Market is the time elapsed between 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 consider are develop.
- In order to shorten the time to prototype, make use of all possible option like use of reuse, off the self component etc.

Per unit and total cost

- Cost is an important factor which needs to be carefully monitored. Proper market study and cost benefit analysis should be carried out before taking decision on the per unit cost of the embedded product.
- When the product is introduced in the market, for the initial period the sales and revenue will be low
- There won't be much competition when the product sales and revenue increase.