Purpose of Embedded Systems

Depending on the user applications, embedded system are designed to perform various operations. An embedded system used for the accomplishment of a particular purpose employ any of the following tasks,

1. Data Collection/Storage/Representation

Data collection is a mechanism used for storage, analysis, manipulation and transmission of data. An embedded system designed for the data collection purpose is used to carry out data acquisition from the external world. The collection mechanism of an embedded system depends on the type of data used. An embedded system with analog data capturing techniques directly collect data in the form of analog signals. In contrast to this, the embedded systems equipped with digital data capturing techniques first converts the analog data into its equivalent digital form using A/D converter and then collects it. Depending on the purpose of embedded system, the data collected is served for any of the following actions,

(i)   Data directly stored in the system.

(ii) Data transferred to the external world.

(iii) Data processed by the system itself.

(iv) Data deleted after performing its task.

(a) Analog or digital CRO examples without storage memory is an example of embedded systems purely designed for the measurement purpose.

(b) LCD's, LED's alarms and buzzers are the examples of equipments used in embedded system to provide audio/visual representation of the collected data.

(c) Digital camera is the best example of an embedded system which provides data collection, storage as well as representation of data.

2. Data Communication

Data communication can be defined as the transmission of data, collected by an embedded terminal from one system to the other. These embedded data communication systems are widely used in applications ranging from complex satellite communication systems to simple home networking systems. Data transmission can be carried out by using either a wired medium or a wire-less medium and can be in the form of analog or digital.

The embedded terminal used for data collection also provides data communication units such as wireless modules. Example, Bluetooth, zigbee, Wi-Fi, EDGE, GPRS etc., or wired modules, RS-232, USB, TCP/IP, PS2 etc. Some embedded systems act as a dedicated transmission unit between the end-to-end terminals and provides cutting edge functions such as data packetizing, encryption and decryption. Examples of some typical dedicated data transmission embedded systems which provides data security and monitoring functions are network herbs, routers, switches etc.

3. Data/Signal Processing

An embedded system equipped with signal processing functionalities can be used for signal processing application such as speech coding synthesis, audio/video codec and transmission. The best example of signal processing application is a digital hearing aid which is used to enhance the hearing capability of a deaf person.

4. Monitoring

Embedded systems used for monitoring purpose have wide applications in medical field. These systems perform monitoring operation on the state of variables by using input sensor without control over the variables. For instance an Electro Cardio Gram (ECG) machine used for monitoring the heartbeat of a patient is a typical example of monitoring application. The other examples include digital CRO, digital multimeters and logic analyzers.

5. Control

Embedded systems employed in the control applications, introduce control over the variables with respect to the changes produced in their inputs. These type of systems are equipped with both sensors and actuators. Sensors are used for monitory changes in measuring variable whereas the actuators are meant for controlling the changes in the input variable, to a specified range. A typical example of such system is an air conditioner.

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6. Application Specific User Interface

Embedded systems with application specific user interfaces provides the user with interfaces such as buttons, switches, keypad, light etc to access a particular device. A suitable example for an application specific user interface is a mobile phone.

The various application areas of embedded systems are listed below,

1. Automotive electronics

2. Aircraft electronics

3. Telecommunications

4. Trains

5. Medical systems

6. Robotics

7. Military applications

8. Consumer electronics.