

• Washing Machine

A washing machine from an embedded systems point of view has:

- a. Hardware: Buttons, Display & buzzer, electronic circuitry.
- b. Software: It has a chip on the circuit that holds the software which drives controls & monitors the various operations possible.
- c. Mechanical Components: the internals of a washing machine which actually wash the clothes control the input and output of water, the chassis itself.

ELEMENTS OF EMBEDDED SYSTEMS.

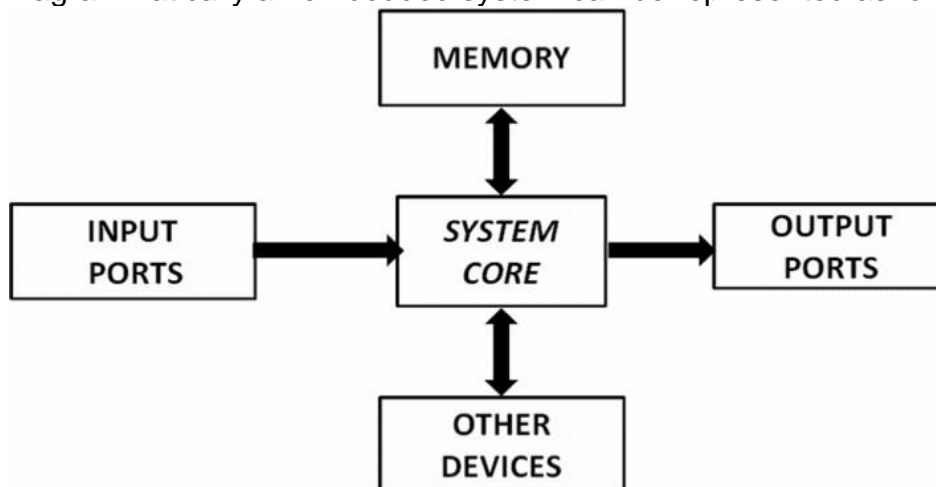
• As defined earlier, an embedded system is a combination of 3 things:

- b. Hardware
- c. Software
- d. Mechanical Components

And it is supposed to do one specific task only.

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Diagrammatically an embedded system can be represented as follows



: Elements of an Embedded System

- Embedded systems are basically designed to regulate a physical variable (such as Microwave Oven) or to manipulate the state of some devices by sending some signals to the actuators or devices connected to the output port system (such as temperature in Air Conditioner), in response to the input signal provided by the end users or sensors which are connected to the input ports.
- Hence the embedded systems can be viewed as a reactive system.

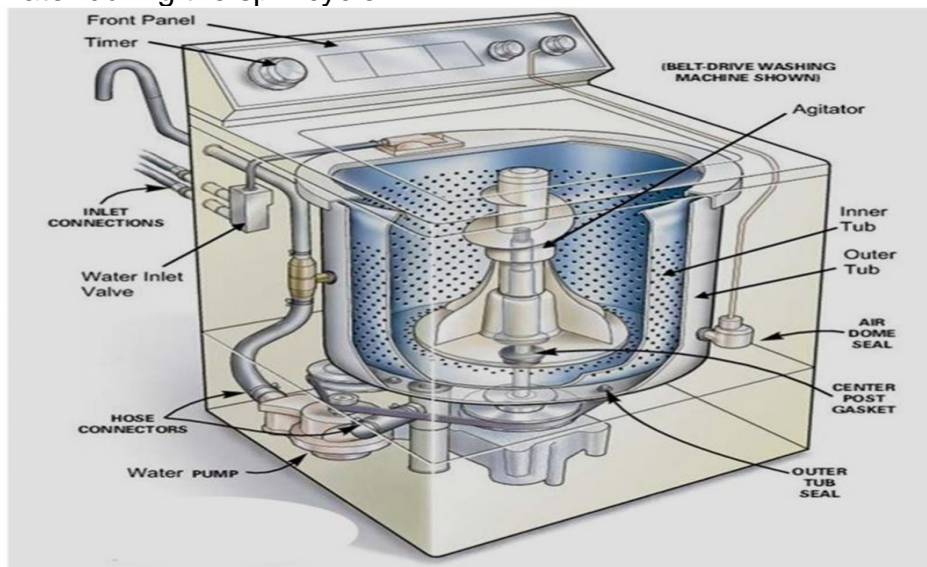
- Examples of common user interface input devices are keyboards, push button, switches, etc.
- The memory of the system is responsible for holding the code (control algorithm and other important configuration details).
- An embedded system without code (i.e. the control algorithm) implemented memory has all the peripherals but is not capable of making decisions depending on the situational as well as real world changes.
- Memory for implementing the code may be present on the processor or may be implemented as a separate chip interfacing the processor In a controller based embedded system, the controller may contain internal memory for storing code
- Such controllers are called Micro-controllers with on-chip ROM, eg. Atmel AT89C51.

Washing Machine

Let us see the important parts of the washing machine; this will also help us understand the working of the washing machine:

1) Water inlet control valve: Near the water inlet point of the washing there is water inlet control valve. When you load the clothes in washing machine, this valve gets opened automatically and it closes automatically depending on the total quantity of the water required. The water control valve is actually the solenoid valve.

2) Water pump: The water pump circulates water through the washing machine. It works in two directions, re-circulating the water during wash cycle and draining the water during the spin cycle.



:Parts of a Washing Machine

3) Tub: There are two types of tubs in the washing machine: inner and outer. The clothes are loaded in the inner tub, where the clothes are washed, rinsed and dried. The inner tub has small holes for draining the water. The external tub covers the inner tub and supports it during various cycles of clothes washing.

4) Agitator or rotating disc: The agitator is located inside the tub of the washing machine. It is the important part of the washing machine that actually performs the cleaning operation of the clothes. During the wash cycle the agitator rotates continuously and produces strong rotating currents within the water due to which the clothes also rotate inside the tub. The rotation of the clothes within water containing the detergent enables the removal of the dirt particles from the fabric of the clothes. Thus the agitator produces most important function of rubbing the clothes with each other as well as with water. In some washing machines, instead of the long agitator, there is a disc that contains blades on its upper side. The rotation of the disc and the blades produce strong currents within the water and the rubbing of clothes that helps in removing the dirt from clothes.

5) Motor of the washing machine: The motor is coupled to the agitator or the disc and produces its rotator motion. These are multispeed motors, whose speed can be changed as per the requirement. In the fully automatic washing machine the speed of the motor i.e. the agitator changes automatically as per the load on the washing machine.

6) Timer: The timer helps setting the wash time for the clothes manually. In the automatic mode the time is set automatically depending upon the number of clothes inside the washing machine.

7) Printed circuit board (PCB): The PCB comprises of the various electronic components and circuits, which are programmed to perform in unique ways depending on the load conditions (the condition and the amount of clothes loaded in the washing machine). They are sort of artificial intelligence devices that sense the various external conditions and take the decisions accordingly. These are also called as fuzzy logic systems. Thus the PCB will calculate the total weight of the clothes, and find out the quantity of water and detergent required, and the total time required for washing the clothes. Then they will decide the time required for washing and rinsing. The entire processing is done on a kind of processor which may be a microprocessor or microcontroller.

8) Drain pipe: The drain pipe enables removing the dirty water from the washing that has been used for the washing purpose.