

Module 1

1.2. Embedded System

Example-Washing Machine



Contents

- Washing Machine- various Input& Output
- Data Flow Diagram
- Operating Principle and working with blockdiagram
- Development Cycle of washing machine
- Case studyWashing machine -Animation and video presentation

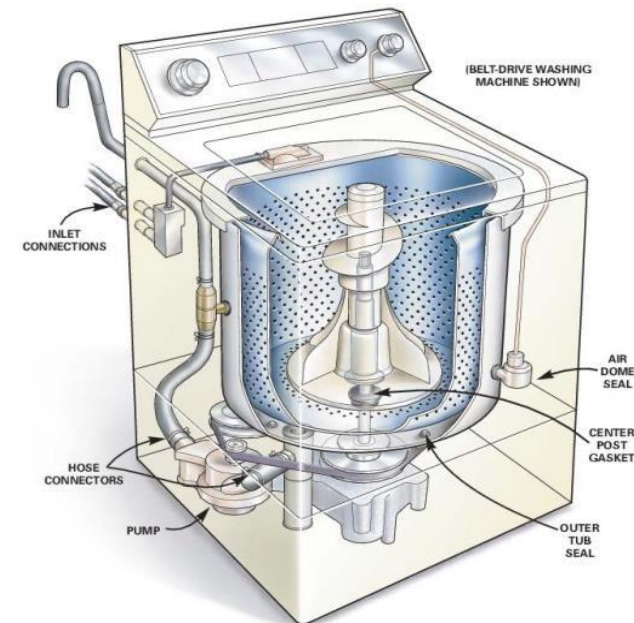
Washing machine

It is an automatic clothe washing **SYSTEM**

Parts: Status display panel, Switches & Dials, Motor, Power supply & control unit, Inner water level sensor and solenoid valve.

Rules

1. Wash by spinning
2. Rinse
3. Drying
4. Wash over by blinking
5. Each step display the process stage
6. In case interruption, execute only the remaining



Inputs-Washing Machine

- User push button: These are various buttons used for the interaction with user.
- Water Temperature: The temperature sensor senses the current temperature of the water and give this temperature as an input to the controller.
- Drum Speed: Current speed of drum is sensed and this input is also given to the controller.
- Water Level Sensor: this input gives current temperature of the water.
- Door close switch: it is used to sense whether the door is closed or not.

OUTPUTS

- Drum Motor: It is connected with the washing machine drum and it is used for rotating drum.
- Water Heater: This signal is the output from controller and input for water heater which is used to switch on or off the heater.
- Water Pump: This signal is used to control the water pump of the washing machine.
- Water Valves: This signal is used to open or close the water valve of washing machine.
- User Display: It indicate the current ongoing activity and other signals related to washing machine.
- Door Release: It is the signal for releasing the door for washing machine.

DATA FLOW DIAGRAM FOR WASHING MACHINE

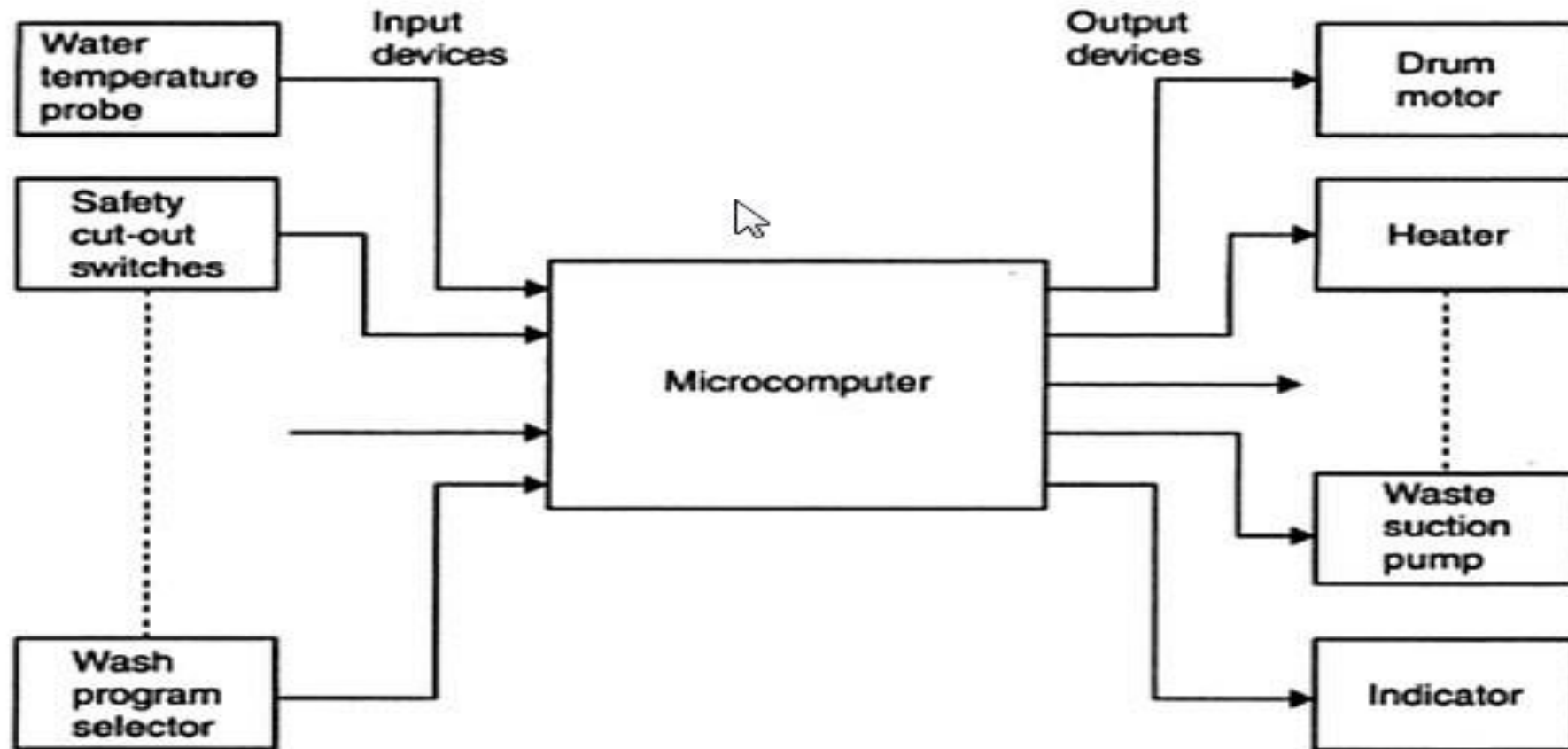


Fig. 51.6 Data flow chart for a washing machine control

PRINCIPLE OF WASHING MACHINE

The washing machines are very commonly used electronic controlled home appliances. Modern washing machines are fully automatic. That is, they wash the clothes according to their type and degree of dirtiness. The washing machines also detect the type of clothes and then select the programs for washing. The modern washing machines use microcontrollers or microcomputers with sufficient memory and keyboard/display etc facilities. The modern fully automatic washing machines use the advanced control techniques like fuzzy logic to implement washing algorithms. Such washing machines decide wash cycle, hot/cold water requirement, agitate/spin/soak/rinse wash modes, wash times etc on their own depending upon the volume of clothes and their dirtiness.

BLOCK DIAGRAM

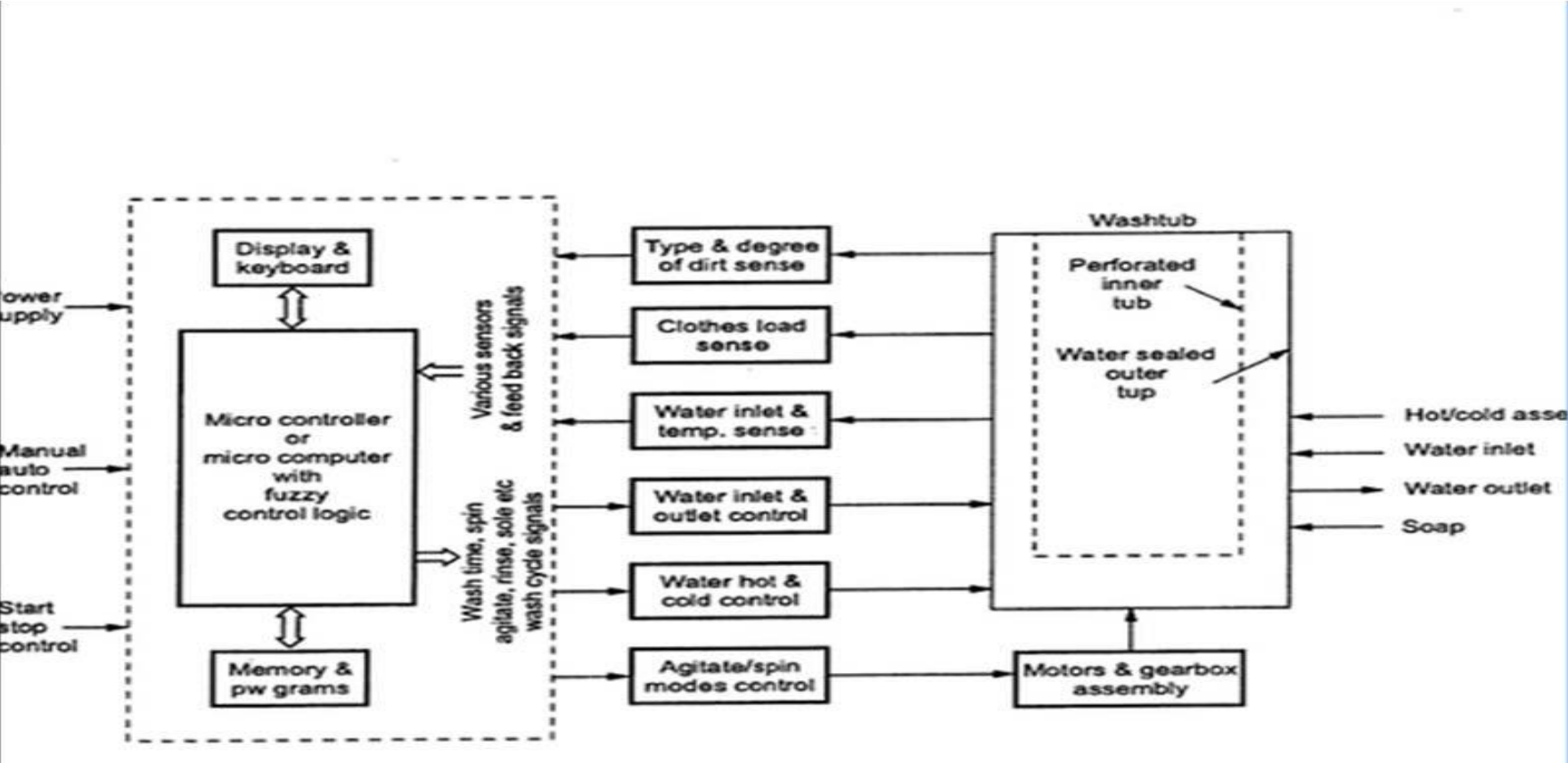


Fig. 6.8.1 Block diagram of washing machine

WORKING

6.8.2 Block Diagram

Fig. 6.8.1 shows the block diagram of washing machine. It uses the micro controller or micro computer as the central controller. The controller has LCD or LED display and keyboard for program entry. The machine can be operated in manual or auto modes. The machine has two washing tubs. The inner tub is perforated. This tub contains the clothes to be washed. The outer tub is waterscaled. The outer tub has hot/cold water inlets, water outlets, soap inputs etc. The wash tubs are attached to the motor and gear box assembly.

Please refer Fig. 6.8.1 on next page.

The controller senses volume of clothes, type of dirt and degree of dirt. Depending upon this data, the controller decides various timings of the wash cycle. The controller controls the mixture of hot/cold water, detergent/soap etc. After you fill the inner tub with clothes, the machine fills the tub with water. The controller then adds the detergent to the water. The controller then agitates the inner tub. After the completion of agitation time, the washer drains the water. The solenoid valve of water outlet is opened. The controller spins the inner tub so that water comes out of the holes and goes to the outlet. The controller then refills the wash tub, agitates again for some time and spins the inner tub to rinse out the soap. This washing cycle continues till the time estimated by the controller.

DEVELOPMENT CYCLE FOR WASHING MACHINE

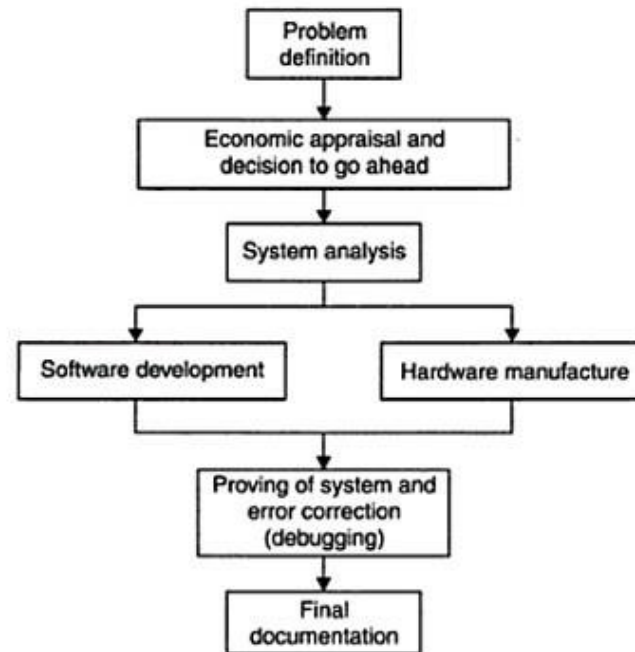


Fig. 51.5 Developing the system for washing machine control

Continue...

- **Problem Definition:** In this stage of development first we have to define a definition for washing machine which is used to identify various requirement of problems and also we can understand the whole problem related to washing machine.
- **Economic appraisal and decision to go ahead:** Once the problem definition is completed then the next step is whether the definition is economically appraise of not. If it is appraise, then they took decision to go ahead for same definition.
- **System Analysis:** Next step for development cycle is to analyze whole the system and indentify requirement of various hardware and software.
- **Software and Hardware Development:** Once identification of various software and hardware is done, next step to develop software and then develop hardware according to that software.

Continue...

- **Error Correction(Debugging):** Once software and hardware is developed, then next step is to test both. If there is error during testing then it is solved by testing hardware and software.
- **Final Documentation:** Once all the error is solved then next step is to create the final product and prepare the final documentation.

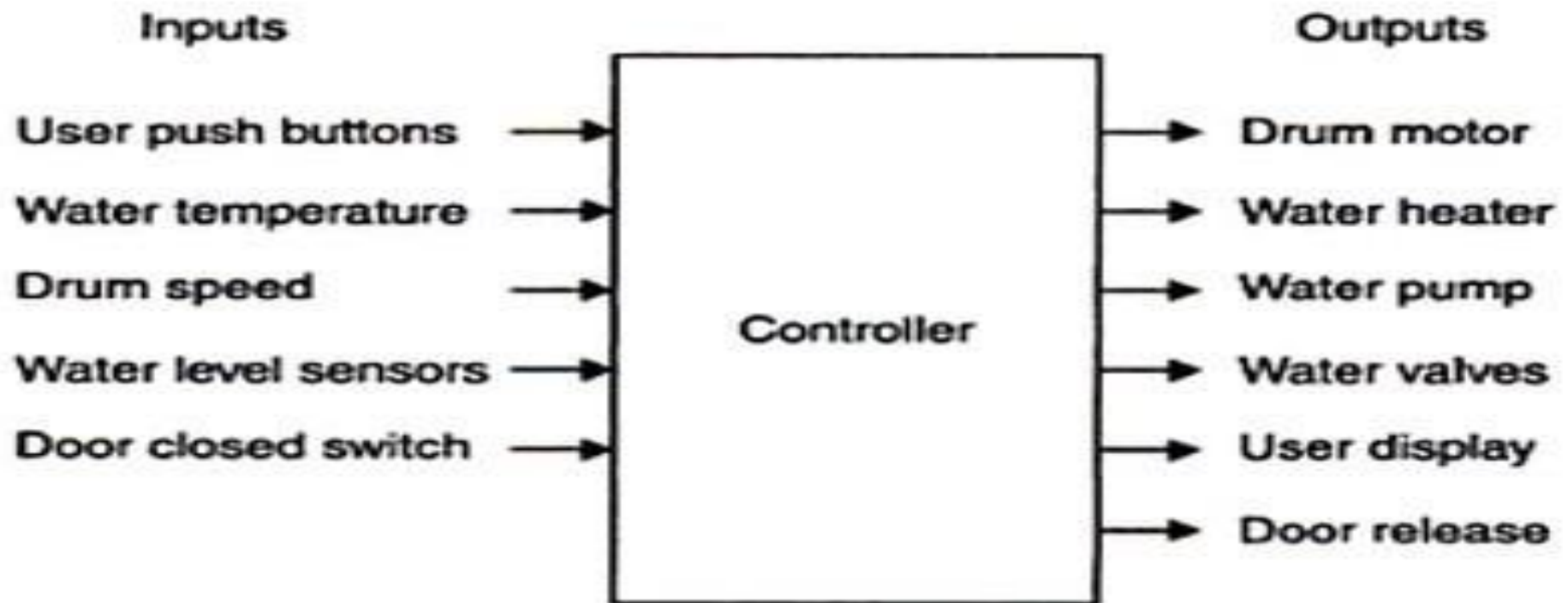


Fig. 51.1 *Inputs and outputs in an electronic washing machine*