

Title: Suggest and design a minimal CPU architecture for controlling the washing machine.

Objective:

The objective of this project is to design an architecture of a washing machine which design can be used in a hardware of a washing machine. A washing machine (laundry machine, clothes washer, or washer) is a machine used to wash laundry, such as clothing and sheets. The term is mostly applied to machines that use water as opposed to dry cleaning (which uses alternative cleaning fluids, and is performed by specialist businesses) or ultrasonic cleaners.

Theory:

The earliest laundry machines simply applied a laundry action once loaded with garments and soap, stuffed with hot water, and commenced.

Washing machine supports two functional modes:

- i) **Automatic Mode:** In fully automatic mode, once the system is started it perform independently without user interference and after the completion of work it should notify the user about the completion of work. This mode instantaneously sense cloth quality and requirement of water, water temperature, detergent, and load, wash cycle time and perform operation accordingly.
- ii) **Manual Mode:** In this mode, user has to specify which operation he wants to do and has to provide related information to the control system. For example, if user wants to wash clothes only, he has to choose 'wash' option manually. Then the system ask the user to enter the wash time, amount of water and the load. After these data are entered the user should start machine. When the specified operation is completed system should inform the user.

Sequence of washing the clothes with this can be explained in few steps as follows:

- Put on your dirty clothes on to the wash tub for washing
- Put the detergent Soap (of your choice like Surf n Excel etc.)
- Put ON the tap, water rushes inside the tub.
- If its electronic control , then by the press of the keys ,you could program , if its mechanical it shall something like an mechanical switches wherein you are allowed to operate f or setting the wash time.
- Now the wash motor rotates and washes the clothes and gives you a beep sound
- Now your clothes are washed ...remove it from the wash tub and put it on the spin tub and program it accordingly...after spinning clothes are dried and you are allowed to hang it for proper drying in sunlight.

Design:

A washing machine may have a System Controller (Brain of the System) which provides the power control for various monitors and pumps and even controls the display that tells us how the wash cycles are proceeding. A washing machine comprise several components as shown in Figure 1.

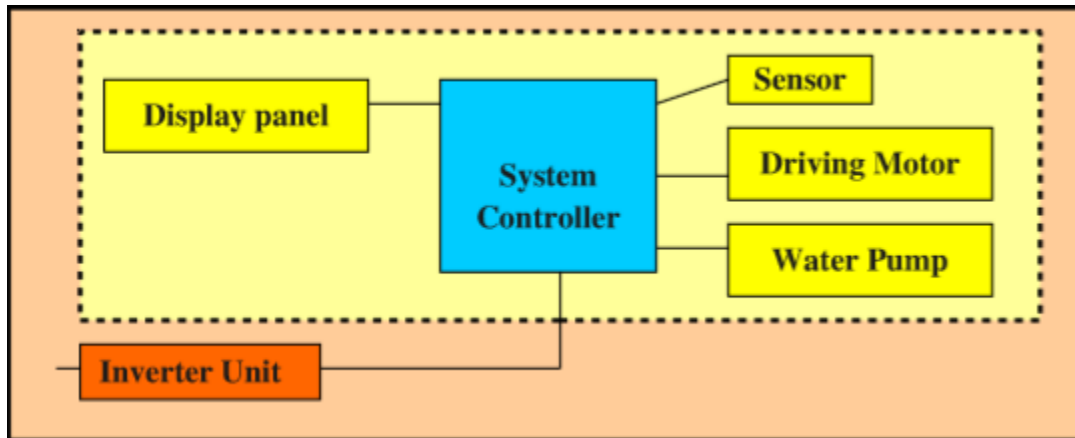


Figure 1: Block Diagram of Washing Machine

The working of these components is as follows:

- **Display Panel:** It is a touch panel screen to control all the operations of a machine.
- **Sensor:** It measures the water level and appropriate amount of soap. Input devices for automatic washing machine are sensors for water flow, water level and temperature; door switch; selector knob or buttons for settings such as spin speed, temperature, load size and types of wash cycle required.
- **Driving Motor:** Motor can rotate in two directions either “reverse” or ‘forward’. The forward direction drives the current in forward direction and motor rotates forward. The reverse direction driver does the opposite of it.
- **System Controller:** Such Component is used to control the motor speed. Motor can move in forward direction as well as reverse direction. System Controller reads the speed of motor and controls the speed of motor in different phases such as in Washing, Cleaning Drying etc. All kinds of Sensors such as Door Sensor, Pressure Sensor and Keypad, Speed sensor are also maintained by this.
- **Water Pump:** The water pump is used to recirculate water and drain out the dirty water. This pump actually contains two separate pumps inside one: The bottom half of the pump is hooked up to the drain line, while the top half recirculates the wash water. The motor that drives the pump can reverse direction. It spins one way when the washer is running a wash cycle and recirculates the water.

Algorithm:

- We created two mode for washing process.
 - Automatic mode
 - Manual mode
- User can select either automatic or manual mode based on their preference.
- Automatic mode will have the temperature variable, washing time variable present which user cannot initialize when user call this mode.
- Manual mode will allow user to initialize temperature variable, washing time variable and choice of operations to be performed.
- For both modes the program will ask for what to wash and types of cloths and it will ask to start the washing process.
- Finally, operations starts with LED on and after washing process is done LED will be turned off.

Implementation and Functions:

- **Implementation**
- **Code organization:**
Manual mode and automatic mode are two separate functions. Breaking down the code makes it easier to read. We would also export some other parts to separate functions, especially the main cycle.
- **Variable initialization:**
We would initialize each variable explicitly to some default value, even if it is sure to be initialized later. In this way, we can for sure prevent undefined behavior.
- **Control flow:**
In the do-while loop for the washing-cycle, start Pause is read, but then, at the end of the loop, it is set to a constant value (independently of what has been read). So this loop only runs once.
- **Input validation:**
In more places, input is required from the user, but it is never checked if it is within the range of the allowed values.
- In a production system this would be a must but we would clarify if this is required.

- **Functions**

There are 3 types of sensor in our code.

- **Temperature sensor:** This sensor will work while the temperature is 25°C or more. Our room temperature is 25°C. So less than this temperature our system won't work.
- **Door sensor:** Door sensor will detect if the door is open or close. If the door is open then process will halt.
- **Water level sensor:** This sensor will measure the water level. For example, if our cloth is cotton then we need more water than silk cloths.

In our system we define the water level sensor for various types of cloths.

We also declare an important variable "timeToWash". As we know in washing machine spin speed refers to how many times your washing machine's drums pins round in a minute. It's measured in revolutions per minute (rpm) - so a setting of 1200rpm means the drum will spin all the way round 1200 times every minute.

Generally, a higher spin speed is used to remove water at the end of a cycle. But we use only how many times our cloths will spin. For shirt we declare the time for 15 minutes while for jacket or other heavy clothes we set the time 40 to 60 minutes. Another thing, we also predefine that, the time must be more than 6 minutes.

manualMode(): In this mode, user has to specify which operation he wants to do and has to provide related information to the control system.

For example, if user wants to wash clothes only, he has to choose 'wash' option manually. Then the system ask the user to enter the wash time, amount of water and the load. After these data are entered, the user should start the machine. When the specified operation is completed system should inform the user.

defaultMode(): In fully automatic mode, once the system is started it perform independently without user interference and after the completion of work it should notify the user about the completion of work. This mode instantaneously sense cloth quality and requirement of water, water temperature, detergent, and load, wash cycle time and perform operation accordingly.

Debugging-Test-run:

In our project fool-proof isn't done as a result of if we tend to implement this code into a hardware machine, there'll be a selected button for the users to allow the inputs. Thus users don't have any alternative rather they're going to provide input using those button.

Future Improvements:

We can implement some a lot of and complicated perform for future which is able to be economical to form the laundry processes quicker and fewer costly. Such design are going to be ready to be applied to hardware machine.

Conclusion:

We already got totally different reasonably washer, that area unit getting used in daily cloths laundry purpose. This project can facilitate us to grasp the design of straightforward washer and can enhance our information of understanding alternative machine design yet as pc design.