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### Washing Machine

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#### INTRODUCTION:

The washing machine is a great appliance. It frees us from the burden of washing our clothes, especially jeans and bedspreads. The spin dryer is a great help, too, considering it wrings out the clothes to remove water and speed up drying time. However, most washing machines employ a mechanical timer to control it.

The timers are prone to breakdown and the electrical contacts wear out. Sometimes, it is often hard to stop the machine, because the only way to do it is to turn it counter clockwise. The result of this is that the timer mechanism does not go back to its home position. Enter the auto washer controller using a PIC12C508 microcontroller.

#### APPLICATION OPERATION:

The 6 pins of the controller are expanded using CMOS ICs. The two 4051 mux are for input and output and the 4015 Shift Register and BCD to 7 segment decoder are for the display. Using some software manipulation, it is possible to produce 8 inputs and 8 outputs provided that they happen one at a time. Using three I/O lines and one input, you can multiplex 8 input signals. With the same three I/O lines, one can output 8 single events. One I/O is used to disable the output multiplexer so that it can scan the input. The two seven segment displays are controlled using a shift register and two BCD to seven segment decoder. The bits are outputted to the shift register using one I/O pin and one from the output mux.

The tricky part is to make the induction motor go forward and reverse using a single pin. Washing machine motors utilizing new fractional horsepower induction motors are made in such a way that the starting winding and the running winding have the same electrical

characteristic. They are like the one used in electric fans, which do not employ centrifugal switches and a very large starting torque. Centrifugal switches are used to disable the starting winding once the motor has developed enough speed and hence centrifugal force to make the weights connected to the switch to fly off and break the connection. If this is not done, the starting winding will heat up. However, this is used for motors with very high starting torque. The starting winding has a high ohmic resistance but low reactance giving a kick to the rotor due to the size of wire used and the capacitor. The running winding has a low resistance but high reactance providing the rotating field. Equally important, the motor does not only need a rotating field but another field with a slight electrical deviation from the rotating field generated by the running winding. This is the work of the starting winding.

The method used to reverse the spin of the motor is to reverse the connection of the starting cap and one terminal of stator. This is possible since the running winding and starting winding have the same electrical characteristic. The motors used today have only three terminals. To accomplish the reverse action is to use four triacs switching two at a time, two forward and two backward. However, the danger is that cross conduction might happen. To prevent this, a driver circuit is connected to the pin. It has a very slow turn ON but a very fast TURN OFF. Included is a spice generated waveform of the driver circuit. To provide a very high electrical isolation, it is necessary to use solid state relays. They are rugged and compact. If they are not used, some logic circuits and an optocoupler must be used to drive the triac.

To sense the level of the water, two electrodes are used which becomes a closed circuit when water becomes a conductor between the two. Water is a non-conductor with a resistance in the megaohm region. However, because of the dissolved impurities, they become ions and the water becomes an electrolyte. The washer is filled with water using a valve controlled by a solenoid.

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# Automate the Home

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## To Operate the System

The washer has five buttons. The START, STOP, UP, DOWN and ENTER are the user interfaces. The washer starts with default values. The wash time is fifteen minutes and the rinse time is five minutes.

The rinse cycle is repeated twice, replacing the water. To change the values, one must push the UP or DOWN to increase or decrease the value. If one is satisfied with the values, one must push the ENTER button. If one needs to start or stop the machine, one must press the START or STOP button. An LED will light to indicate if the value incremented is WASH time or RINSE time.

## Flexibility of the System

Since the system is controlled by a PIC12C508, one can add features in software. One example is to learn how long it takes to fill and empty the tank and sound an alarm if the water line is closed or the drain line is clogged. One can also change the number of cycles.