

## “Design of basic model of semi-automatic dish washer machine”

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**Abstract:** Main aim of semi-automatic dish washer machine is to reduce human efforts and time with its innovative simple design which is also environment friendly. A dishwasher is a low cost machine made up of easily and readily available parts in daily life. The model of semi-automatic dish washer machine is new concept, which in its one washing cycle does all the operations of conventional dish washing i.e. spraying soda water, scrubbing with brush and rinsing with clean water similar to fully automatic dish washer machines in market. The dishwasher operates with help of DC motor, Universal motor, conveyor belt and microcontroller for time delay. Dish which is placed on the conveyor belt enters the first washing chamber where it is cleaned with soda water and scrubbed with the brushes. This is then passed to next chamber where it is rinsed with the clean water and finally moves out as a complete washed dish.

**Keywords -** semi-automatic dish washer machine

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### I. INTRODUCTION

In India, Dish washing activity is manual process involving considerable human efforts or with automatic Dish washing machines available in market which are expensive. Manual Dish washing activity requires more number of people and also it is time consuming process involving human efforts. Cost required for labour work is also considerably high. This project intends to solve the problems faced by many persons in their day-to-day life. Thus the attempt has been made to achieve solution of above problems with semi-automatic dish washing machine with objectives that it should minimise human efforts and should have low cost with less time consumption and must have all the basic mechanisms – washing with soda water, scrubbing with brush and rinsing in clean water.

### II. DESIGN

This section gives a brief idea and analysis of the semi-automatic dish washer machine. It also states the mechanisms incorporated in this model for the process of washing the dish.

#### A) Mechanism

Dishes are washed in semi-automatic dish washer machine like any other machine mainly consisting two steps  
1 Washing with soda water & scrubbing with brush  
2 Rinsing with clean water

##### 1 Washing with soda water & scrubbing with brush

In traditional washing of dish, first step is to clear the wastage food on plate and then scrub it with detergent. Here also, we are following same first step in which the dirty dish which has to be wash is put in first washing chamber. Where scrubbing & washing of dish takes place.

Dish put on the conveyor belt is operated by using universal motor. The motor stops when dish enters in washing chamber.

Universal motor is operated with delay of specific time interval and entire operation of system is controlled by using microcontroller.

In this chamber, firstly pressurized spray of detergent water is thrown on dish with the help of nozzles. The operation performed with help of water pump.

Pressurized detergent water clears dish with the waste food. Simultaneously brush assembly operates which moves the brushes down and starts scrubbing of dish. The up & down movement of brush assembly is operated by DC geared motor controlled according to logic program given to microcontroller. These complete operations are to be carried out in stipulated time span set by microcontroller. After that the conveyor belt moves again in forward directions automatically to move dish to second washing chamber.

##### 2 Rinsing with clean water

The semi-automatic dish washer incorporates the mechanisms used in fully automatic washing machines as well as the one used in hand washing to ensure effective washing of dishes with the delay provided by microcontroller.

When the conveyor belt enters in next fresh water chamber, motor automatically stops. Here pressured clean water is spread on a dish with the help of another pump and dish is perfectly cleaned. After particular time delay given by microcontroller the conveyor belt moves and dish moves out of machine & placed in tub.

#### B) Design of component

##### 1. Frame

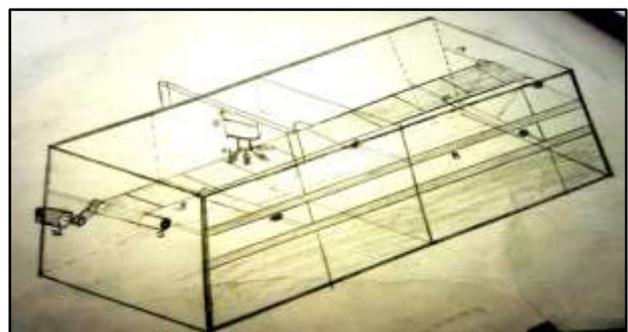


Figure 1: Mechanical Assembly

In this section, the whole accessories are to be mounted on a frame, which is made up of ms angles.

The dimension of frame is given as below,  
Length: 120cm  
Height: 100cm  
Width: 45cm

The total necessary assembly of frame is to be made by using an electric arc welding. Frame is two layered assembly, on top layer two washing chambers are placed and on bottom layer three tanks are placed. An angled metallic strip is also welded on the frame to provide support for washing chambers and also support for water tank. In above figure1, different points are marked to define the positions of components.

### 2. Conveyer belt

The conveyer belt (marked with point3 in Figure 1) is to be mounted on roller (marked with 2 in Figure 1). This roller is used for smooth rotations of conveyer belt and is fixed on a bearing. The diameter of bearing is 15mm. For the rotation of conveyer belt a universal motor is connected on either side of frame.

### 3. Power supply requirement

Power supply requirement of automatic dish washer machine

- 1) For brush motor 12V, 2.2A
- 2) For DC water pump 12V 1.3A
- 3) 5V supply for microcontroller
- 4) 12V geared motor

AC supply of 230V is used to operate universal motor. Automatic dish washer machine requires 230V AC as well as 12V & 5V constant DC power supply.

The rectifier circuit developed fulfills the DC supply required.

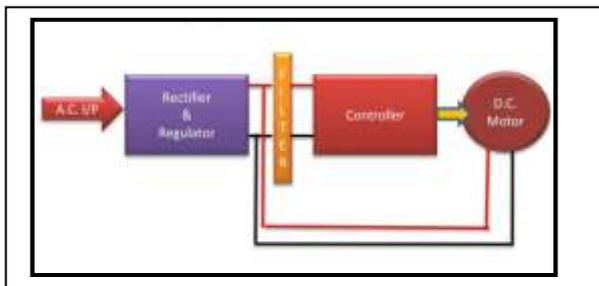


Figure 2: Power Supply Block Diagram

### 4. Universal motor

Universal motor is operated with 230V, 50Hz AC supply (For position of motor refer point no5 of Fig 1)

Universal motor is used to operate conveyer belt. The microcontroller based time delay is provided such that the motor is operated for few seconds causing the motion of the conveyer belt from chamber to next chamber. The run time of motor is kept very less due to its high speed of rotation. The start and stop operation is performed with help of relay.

### 5. DC brush motor

It's supplied with 12V, 2.2A DC supply. (For position of motor refer point no5 of Figure 1)

It's placed in washing chamber and fitted on the top of chamber. Its main function is to move the brush assembly up

and down by clock wise & anti clockwise rotation with help of delay provided by microcontroller. When dish is placed on conveyer belt it enters washing chamber, then DC brush motor will bring down brush assembly and after particular delay it will again go up.

### 6. DC Geared motor

It's supplied with 12V DC supply. (For position of motor refer point no 4 of Figure 1)

Its main function is to rotate the scrubbers/brush assembly attached to it after dish has come below the brush for particular time which is provided by micro-controller and then stops.

### 7. DC Water Pump

12V high pressure water pump is used in semi automatic dish washing machine. There are three plastic water storage tank used in dish washing machine i.e. Soda/detergent water tank, Clean water tank and dirty water tank placed at the base level of the machine (For position of motor refer point no8 of Figure 1)



### 8. IC L293D

L293D is a typical Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. This means that it can control two DC motor with a single L293D IC.

### 9. Microcontroller 8051

Microcontroller is used to provide delay to universal motor, DC brush motor & DC geared motor.

It is interfaced with IC L293D as shown in below diagram.

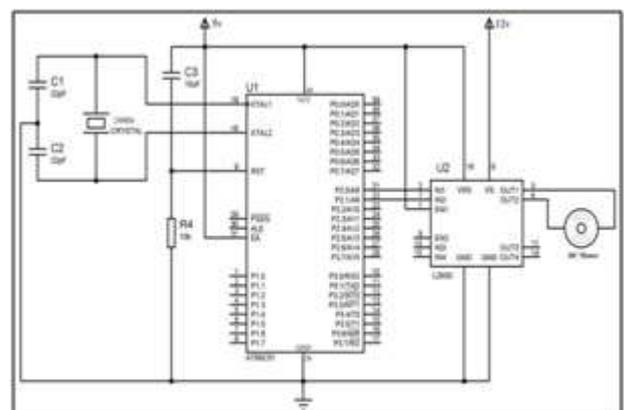


Figure 3: Interfacing of Microcontroller and IC L293D

Following program is used in microcontroller 8051 in C language.

```
#include<reg51.h>
#include<stdio.h>
void delay(void);
sbit motor_pin_1=P2^1; //brush motor
sbit motor_pin_2=P2^2; //geared motor
sbit motor_pin_4=P2^4; // belt motor
void main()
{
motor_pin_1=0;
motor_pin_2=0;
motor_pin_4=0;
while(1)
{
motor_pin_4=1; //start belt motor
delay();
delay();
motor_pin_4=0; //stop belt motor
delay();
motor_pin_1 = 1;
motor_pin_2 = 0; // brush motor Rotates Anticlockwise
Clockwise
delay();
motor_pin_1 = 1;
motor_pin_2 = 1; //Stop brush Motor
delay();
delay();
delay();
delay();
delay(); // wash time
motor_pin_1 = 0;
motor_pin_2 = 1; //Rotates Motor Clockwise
delay();
motor_pin_1 = 0;
motor_pin_2 = 0; //Stops Motor
delay();
}
}
void delay()
{
int i,j;
for(i=0;i<200;i++)
{
for(j=0;j<1000;j++);
}
}
}
```

### III. COST ESTIMATION

TABLE I

SR	MATERIAL	QTY	COST (RS)
1	Mechanical assembly	1	1600
2	PVC pipes & Tubes	As required	350
3	Water Pump	2	800
4	Washing chambers	2	800
5	Universal Motor	1	600
6	Gerard Motor	1	50
7	Microcontroller & other circuitory	As required	740
8	12 Volt DC Motor	1	100
9	Conveyor Belt	1	100
10	Water Tank	3	100
11	Bearing	12	300
12	Nozzle	3	60
13	Funnel	2	20
14	Blade	20	20
15	Paint expenditure		120
16	Other expenditure		1100
<b>Total</b>			<b>6860</b>

### IV. SALIENT FEATURES

The semi-automatic dish washer offers a number of salient features. Listed below are few of them.

- Environment friendly and non-polluting.
- Efficient in operation.
- Less human efforts are required than conventional dish washing techniques.
- Low cost as compared to machines available in market and affordable to all class of people.
- Robust in construction.
- Easy for operating and user friendly.
- Requires only one operator.
- Easy to repair and maintain as components used are easily available in market.
- Saves the valuable time by as time require to wash per dish is less due to automation.
- Portable and light weight so that same can be placed anywhere in home.
- Facility to store dirty water which does not to pollute the surrounding environment.

### V. COCNLUSION

The basic model of semi-automatic dish washer machine is designed to reduce human effort with saving in time while increasing the efficiency for washing a dish. It satisfies the need of small restaurants or family which are not able to buy expensive full automatic machine. The model is built with very basic material and can be more standardise by altering motor

used. The product designed has minimal operating cost, cost-effective, eco-friendly and it can be used with almost zero efforts.

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Actual Project Model

