# Automatic Hand Washer

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***Abstract-*** ***It is important to always wash hands before starting to prepare food and after touching raw food such as meat, poultry and vegetables to prevent bacteria and germs. This system helps to prevent unhealthy pattern of washing of hands in the various restaurant and places of food selling. In the hand washing system, DC motor is used for water flow as a control element to operate sequentially that would be control by the LM 358. The basic operation of this system is hand proximity sensing circuit receives signal and active motor for water flow.***

***Indexed Terms-*** ***LM358, DC motor, Relay, IR sensor***

## I. INTRODUCTION

Hand washing is the act of cleaning hands for the purpose of removing soil, dirt, and microorganisms. Besides, it is the most important things to reduce like flu, food poisoning and healthcare associated infections being passed from person to person. Hand washing is fully control by LM358 and hand proximity sensing circuit. It supplies cleaning water in a sequential order during the washing. These machines are specially designed for used in office, public toilet, testing area and as for the general domestic washing and drying of the hand at home. The usage of these products is to promote hygienic lifestyle.

## II. FUNDAMENTALS OF COMPONENTS

### A. LM358

LM 358 is a great, low power and easy to use dual channel op-amp IC. It is designed and introduced by national semiconductor. It consists of two internally frequencies compensated, high gain and independent op-amps. This IC is designed for specially to operate from a single power supply over a wide range of voltages. The LM 358 is available in a chip sized package and applications of this op-amp include conventional op-amp circuits, DC gain blocks and transducer amplifiers. The LM 358 is a good and standard operational amplifier. It can handle 3 V to 32 V DC supply and source up to 20 mA per channel.
Feature of LM 358

- It consists of two op-amp internally and frequencies compensated for unity gain
- The large voltage gain is 100 dB
- Wide bandwidth is 1 MHz
- Range of wide power supplies includes single and dual power supplies
- Range of single power supply is from 3 V to 32 V
- Range of dual power supply is from ±1.5 V to ±16V
- The supply current drain is very low, i.e., 500 µA
- 2 mV low input offset voltage
- Common mode input voltage range comprises ground
- The power supply voltage and differential input voltages are similar
- Output voltage swing is large

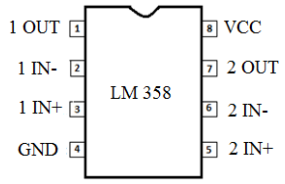


Figure 1.Pin Diagram of LM358

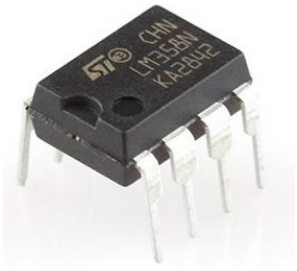


Figure 2. Design of LM358

B. DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

Figure 3.DC Motor

DC motors were the first type widely used, since they could be powered from existing direct current lighting power distribution systems. A DC motor' speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills.

C. Laser Diode Module

A laser diode module provides all the necessary to create an emitting laser frequency. Laser diodes have much in common with regular diodes that do not emit visible light. They are formed from a semiconducting material and are created by joining a p-type and as n-type material together. All diodes, including laser emitters, then have an intrinsic region that forms with no loose holes or electrons. This is called the depletion zone. It is here that the magic happens in a laser diode. These diodes are formed by using semiconductor compounds, which means a combination of two or more atomic types. This creates a unique band gap that facilities into the diodes, there is a constant stream of electron and holes combining in the intrinsic region. This combination creates an automatic condition that allows for the release of a photon. By modifying the materials used in the laser diode, the energy released during this combination can be controlled and the color of light can be selected. This is very similar to the functionality of the modern LED. Regular diodes do not have the necessary atomic structure to released photons, and usually just produce lattice vibrations.

Figure 4.Laser Diode Module

D. Relay

Relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. In this system, 5-pin relay is used. Relay offers easy way for LED to indicate a voltage is present at relay coil. As no input state, the common is connected to normally close and when operating voltage is applied to relay coil.


Figure 5. Relay

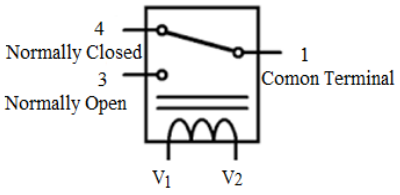


Figure6. The symbol of Relay

## III. OPERATION OF BLOCK DIAGRAM

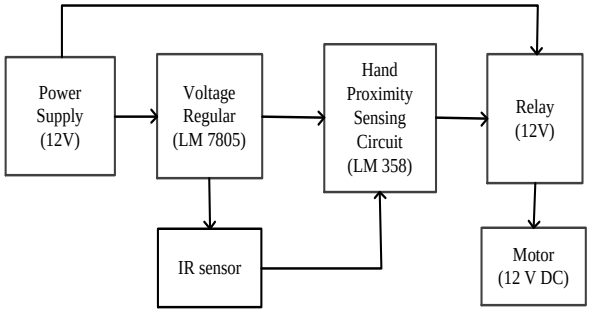


Figure7. Block Diagram of Automatic Hand Washer

In automatic hand washer circuit, LM 358 is used as a hand proximity sensing circuit for driving 12 V relay. The circuit is sense the present of hand with the IR sensor. When the IR ray from the IR transmitter is reflected by the hand, the IR receiver receives IR ray and then it activate the circuit. It drives the 12 V relay and then 12 V DC motor is activated.

## IV. OPERATION OF CIRCUIT DIAGRAM

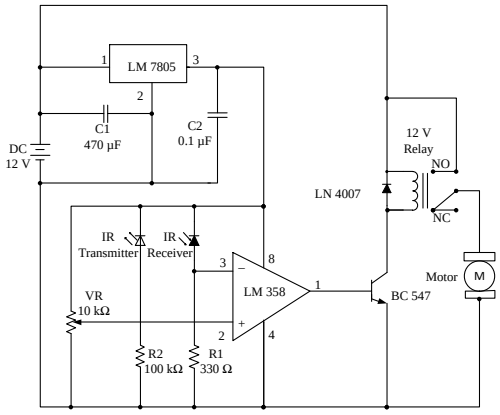


Figure 8.Circuit Diagram of Automatic Hand Washer

In this circuit, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier of LM 358 IC is used as comparator circuit. When the IR receiver does not receive a signal, the potential at the no inverting input (pin 3) goes high than that inverting input (pin 2) of LM 358 IC. Thus the output (pin 1) of the comparator goes high and the current is not flow. When the IR receiver receives signal to the potential at the inverting input (pin 2) goes high. Thus the output (pin 1) of the comparator goes low and the current is flow. Lastly, the output of voltage comparator is fed to transistor BC 547. Since enough voltage appears across the base emitter junction, the transistor conducts and current pass through the relay coin. So relay switched its contacts to and NO (Normally Open) pin will fed 12 V to DC motor. DC motor will activate. Then, DC Motor pumps out water over the hand. The inverting end (pin 2) of voltage comparator LM 358 is connected to a variable resistor of 10 kΩ which is used to set the sensitivity of the circuit. Resistor R1 and R2 are used to ensure that minimum 10 mA current pass through the IR transmitter and IR receiver.

## V. DESIGN CALCULATION OF AUTOMATIC HAND WASHER

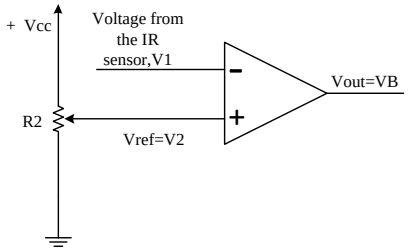


Figure 9.Part of R2 and LM 358

$V_{CC}$ = 5 V

Let $R_{ref}$= 8 kΩ

$I_2$ = 47 µA

$V_{ref} = V_2 = I_2R_{ref}$ Equation (1)

$V_2$ = 47µ×8 kΩ

$V_2$ = 0.4 V

When the IR sensor is sensing the hand, the inverting input,
$V_1 = 0.98$ V
$V_1 > V_2$
Therefore, $V_0$ = the output voltage of LM 358 is low and the transistor BC 547 is OFF. When the IR sensor is not sensing the hand, the inverting input,
$V_1 = 0$ V
$V_2 > V_1$
Therefore, $V_0$ = the output of LM 358 is high and the transistor BC 547 is ON.
$V_1 = 0.98$ V
$V_2 = 0.37$ V
$V_1 > V_2$, $V_0 = V_B$ = LOW, and the transistor BC 547 is OFF

## VI. TEST AND RESULTS OF AUTOMATIC HAND WASHER

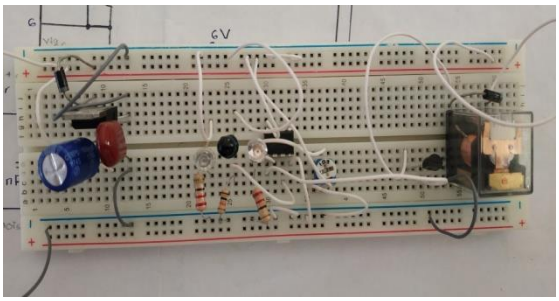

Figure 10. Design of Assembly Components on Printed Circuit Board

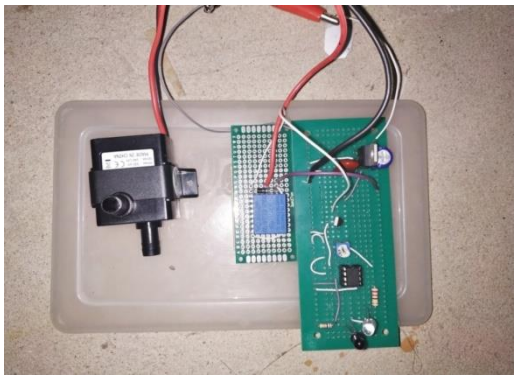

Figure 11. Internal Circuit of Automatic Hand Washer

Figure 12. Final Design of Automatic Hand Washer

## VII. CONCLUSION AND DISCUSSIONS

The use of new electronic theories has been put down by expertise to increase the facilities given by the existing appliance. Here the facility of ordinary hand washing is increased by the making it controlled automatically. Automatic hand washing provides health benefits and automatic application. This system is simple to use and efficient. It is assembled with ease. It is cheap and hence very economic. It is small in size and is fixing inside normal basin. In automatic hand washer, the IR sensor and LM 358 IC are used. In the end, this system is widely used in different places such as public or personal. And then, automatic hand washer is made in low budget. This machine has been tested under many conditions and has given a satisfactory result and has proved to be very efficient. Before construct automatic hand washer, the first important thing is to choose the right components list. It is also needed to study the data sheet of these components. It is tested on universal project board. It is also needed to cover IR transmitter and receiver because it is distract by IR rays from day light. From the primary result it can be seen the main objective which is saving water was achieved.

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