AUTOMATIC HAND DRYER

May Lwin Thant[1], Khine Myint Mon[2], Khin Thandar Tun[3]

[1]Professor, Department of Electronic Engineering, Technological University (Meiktila), Myanmar
[2]Lecturer, Department of Electronic Engineering, Technological University (Meiktila), Myanmar
[3]Lecturer, Department of Electronic Engineering, Technological University (Meiktila), Myanmar

Abstract

Automatic hand dryer is automatically dried the hands. This helps to prevents spreading bacteria from the unclean hand, wastage of paper tower and huge time saver. The hand dryer consists of Light Department Resistor (LDR) and 555 timer IC. The 555 timer IC is work as a monostable mode that it drives with the 5 V relay. Laser light falls on the LDR, the hand drying system remains OFF state and when the laser light is blocked by the hand from falling on the LDR, the hand drying system remains ON state. In the other words, the light from the laser module is cut off by the hand then the dryer is activated.

Keyword: LDR, 555 timer IC, Relay, Fan

1.INTRODUCTION

The transmission of bacteria is more likely to occur from wet skin than from dry skin, the proper drying of hand after washing should be essential component of hand hygiene producers. In the hand dryer system, air blower is used for air flow as a control element to operate sequentially that is control by the 555 timer IC. The 555 timer IC receives instruction from the LDR sensor and then activates the dryer. It supplies warm air current to dry up the completely washed hand. This machine is specially designed for used in various restaurants, office, testing area, public toilet and as for the general domestic drying of the hand at home. The usage of these products is to promote hygienic lifestyle. Besides that, it produces new technology which helps to prevent the wastage of water and easy to use for all user.

2.FUNDAMENTALS OF COMPONENTS

2.1. Light Sensor (Photo-resistor)

A photo-resistor or LDR or Cadmium Sulfide (CdS) cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referenced as a photoconductor.

A photo-resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its whole partner) conducts electricity, thereby lowering resistance.

Figure1. Photo-Resistor

2.2. 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.
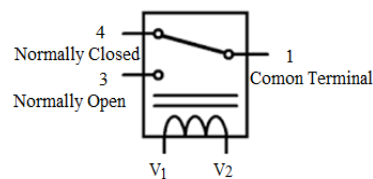

Figure 2. Symbol of Relay

Figure 3. Relay

2.3. 555 Timer IC

The 555 timer can be configured in three difference mode: astable, monostable and bistable mode. In monostable mode, an external resistor and capacitor connected are used to set up the 555 timer as a nonretriggerable one-shot. The pulse width is determine by the time constant of R and C.
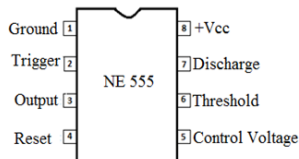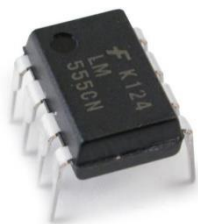

Figure 4. Pin Layout of 555 Timer IC

Figure 5. Design of 555 Timer IC
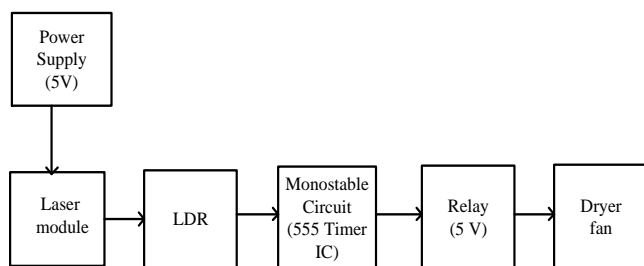
3.OPERATION OF BLOCK DIAGRAM

Figure 6. Block Diagram of Automatic Hand Dryer

Automatic hand dryer circuit is combined with three main circuit; monostable circuit, motion detector circuit and power supply circuit. The 555 timer IC is work as a monostable circuit for driving 5 V relay to emit the LDR

pulse. Motion detector circuit is sense the present of hands through the LDR on which the light beam falls from the laser module. During the time when the laser light is falls on the LDR, the main circuit remains OFF because there is low resistance in the LDR. When the light from the laser module is cut off by the hands then the circuit is activate and then the heating coil and fun will activate.

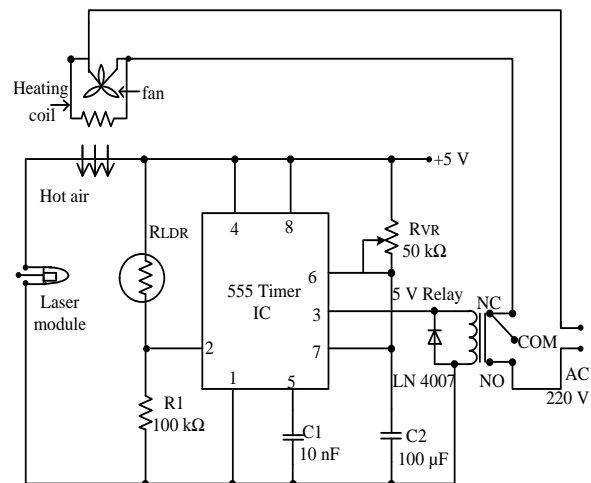### 4.OPERATION OF CIRCUIT DIAGRAM

Figure 7. Circuit Diagram of Automatic Hand Dryer

The circuit comprises of two divisions, one is LDR, the light sensing circuit and another one is 555 timer IC. The LDR is paired with resistor R1 to form a potential divider to feed the trigger voltage to the 555 timer IC. So voltage across LDR changes with intensity of light. It gives maximum voltage when light falls above LDR. The circuit is built around a 555 timer IC which was wired as a monostable mode. Monostable circuit gives a high output in the presence of negative trigger at the pin 2 whereas low output in the presence of positive trigger. This principle was used here to make the 555 timer IC as a switch when light incident in LDR. When there is no presence of light, the potential divider gives a positive trigger to the pin 2 of 555 timer IC. This results in low signal output at the pin 3. Incident of light in LDR makes the potential divider to give out negative trigger to the pin 2. The pin 8 and pin 1 are used to given power VCC and Ground respectively. The 5 pin is grounded via a C_1 (10 nF) to avoid high frequency noise. Threshold pin (pin 6) is connected with potentiometer (50 kΩ) to control

the delay time. So this potentiometer can be used to adjust the operation time of the circuit. When the output is low, discharge pin (pin 7) discharges a C_2 (100 μF) in the RC circuit to ground. The output of the 555 timer IC (pin 3) drives the relay. Since enough voltage appears across the base emitter junction, the transistor conducts and current passes through the relay coils. So relay switches its contact and then activates the heating coil and fan.

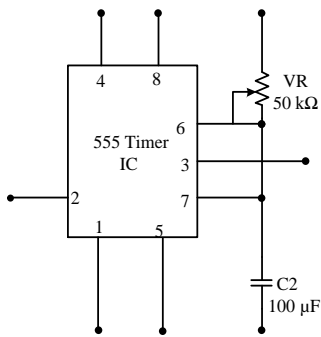## 5.DESIGN CALCULATION OF DELAY TIME OF AUTOMATIC HAND DRYER

Figure 8. Part of VR and C₂

In 555 timer monostable mode,

Delaytime,t_w=1.1RC   Equation (1)

For $V_R(min) = 0$ kΩ,

Minimum delay time, $t_w(min) = 1.1V_R(min)C_2$
$$= 1.1 \times 0 \times 100\ μ$$
$$= 0\ s$$

For $V_R(max) = 50$ kΩ,

Maximum delay time, $t_w(max) = 1.1V_R(max)C_2$
$$= 1.1 \times 50\ k \times 100\ μ$$
$$= 5.5\ s$$

Let $V_R = 45$ kΩ,

The delay time of automatic hand dryer after the hand is passed,

Delay time of hand dryer, $t_w = 1.1V_RC_2$
$$= 1.1 \times 45\ k \times 100\ μ$$
$$= 4.95\ s$$

6.DESIGN CALCULATION OF PIN 2 OF 555 TIMER IC
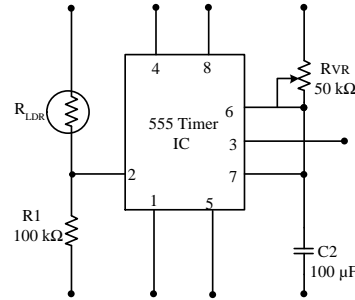
Figure 9. Part of R_{LDR} and R_1

$V_{CC} = 5$ V

 The value from measuring,
 $R_{LDR} = 0.86$ MΩ

The voltage of the pin 2, $V_2 = \dfrac{R1}{R1+RLDR} \times V_{CC}$ Equation (2)

$$= \frac{100\ k}{100\ k + 0.86\ M} \times 5$$

$$= 0.53\ V$$

The $V_2 = 0.53$ V is less than 1/3 V_{CC}, therefore the output voltage is high.

The output voltage at pin 3 from measuring
$$V_{out} = 2.7\ V$$

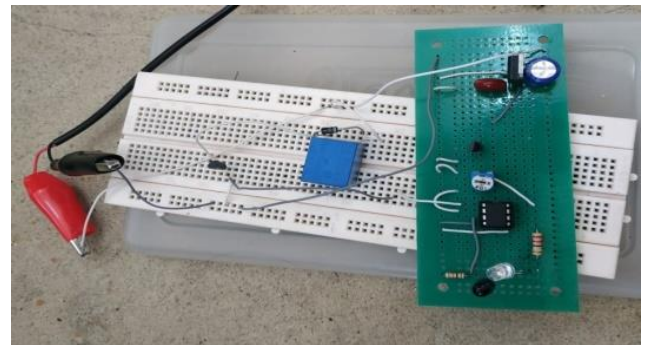## 7.TEST AND RESULTS OF AUTOMATIC HAND DRYER

Figure 10 . Design of Assembly Components on Printed Circuit Board

Figure 11. Internal Circuit of Automatic Hand Dryer

Figure 12. Final Design of Automatic Hand Dryer

8.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 dryer is increased by the making it controlled automatically. Automatic hand dryer provides health benefits and automatic application. It also saves amount of water and time. 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. In automatic hand dryer, the laser and LDR system is highly sensitive with a great range of working. The system senses the light emitted by the laser falling over the LDR connected with the circuit. Whenever the beam of light is interrupted by

any means, it triggers the heating coil and fan. In the end, this system is widely used in different places such as public or personal. And then, automatic hand dryer 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 dryer, the first important thing is to choose the right components list. It is also needed to study the data sheet of these components. Then, it is tested on universal project board. In hand dryer, LDR is too sensitive to light and LED did not send enough light to LDR at day time. It is needed to cover LDR to reduce the sensitivity to light and LED is replaced with laser module to send enough light in day time. A survey analysis was carried out to find the optimum time for hand dryer for different ages.

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