NATIONAL INSTITUTE OF TECHNOLOGY,
WARANGAL

DEPARTMENT OF ELECTRONICS
AND COMMUNICATION ENGINEERING

MINI PROJECT:

"FASTEST SWIMMER FIRST"

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CERTIFICATON

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

NIT WARANGAL, 2017

This is to certify that the undersigned belonging to department of Electronics and Communication Engineering branch, Third year, Section - B have completed the project on LINEAR INTEGRATED CIRCUITS AND APPLICATION

TITLE OF THE PROJECT : FASTEST SWIMMER FIRST

NAME OF FACULTY : K.SRIDHAR SIR

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INTRODUCTION

In this project we implemented a basic swimming competition winner circuit to determine the fastest swimmer in the competition.In this we used the versatile 555 Timer IC which is for 3 swimmers but we can increase the number of participants or players by increasing the no. of 555 IC's or by combining two or more IC's together.

There are three popular configurations of 555 timer IC,

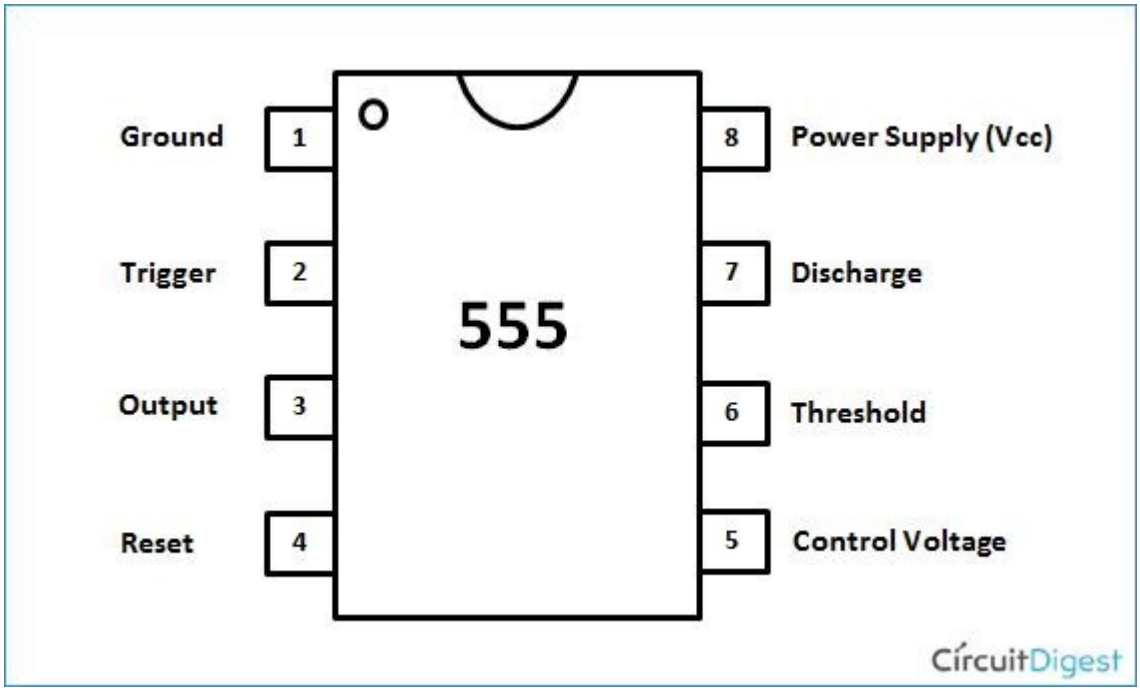
1. **Astable multivibrator**
2. **Monostable multivibrator**
3. **Bistable multivibrator**

They differ by the number of stable states in the circuit. In our case we need Bistable Multivibrator Mode where there are two stable states. The first state is enabled when the participant presses the button and the second state is to reset the timer. Hence, the configuration used here is bistable multivibrator. Here in this Simple Quiz Buzzer Circuit we are about to use three timers. Hence the number of participants is three and the single organizer.

COMPONENTS REQUIRED

1. **555 Timer IC – 3 No.s**
2. **Push Buttons – 4 No.s**
3. **BC547 – 1 No.**
4. **Buzzer – 1 No.**
5. **LED – 6 No.s**
6. **Diodes – 5 No.s**
7. **Transformer 12-0-12 – 1 No.**
8. **Resistors – 10KΩ - 4 No.s ; 1KΩ - 7 No.s**
9. **Capacitor – 4700 microfarads.**
10. **IC 7809 – 1 No.**
11. **Breadboard**
12. **Connecting Wires**

555 Timer Pin Diagram and Descriptions



Now as shown in figure, there are eight pins for a 555 Timer IC namely,

1.Ground.

2.Trigger.

3.Output.

4.Reset.

5.Control

6.Threshold.

7.Discharge

8.Power or Vcc

Pin 1. Ground: This pin has no special function what so ever. It is connected to ground as usual. For the timer to function, this pin must and should be connected to ground.

Pin 8. Power or VCC: This pin also has no special function. It is connected to positive voltage. For the timer to function to work, this pin must be connected to positive voltage of range +3.6v to +15v.

Pin 4. Reset: As discussed earlier, there is a flip-flop in the timer chip. The output of flip-flop controls the chip output at pin3 directly.

Reset pin is directly connected to MR (Master Reset) of the flip-flop. On observation we can observe a small circle at the MR of flip-flop. This bubble represents the MR (Master Reset) pin is active LOW trigger. That means for the flip-flop to reset the MR pin voltage must go from HIGH to LOW. With this step down logic the flip-flop gets hardly pulled down to LOW. So the output goes LOW, irrespective of any pins.

This pin is connected to VCC for the flip-flop to stop from hard resetting.

Pin 3. OUTPUT: This pin also has no special function. This pin is drawn from PUSH-PULL configuration formed by transistors. The push pull configuration is shown in figure. The bases of two transistors are connected to flip-flop output. So when logic high appears at the output of flip-flop, the NPN transistor turns on and

+V1 appears at the output. When logic appeared at the output of flip-flop is LOW, the PNP transistor gets turned on and the output pulled down to ground or –V1 appears at the output.

Thus how the push-pull configuration is used to get square wave at the output by control logic from flip-flop. The main purpose of this configuration is to get the load off flip-flop back. Well the flip-flop obviously cannot deliver 100mA at the output.

Well until now we discussed pins that do not alter the condition of output at any condition. The remaining four pins are special because they determine the output state of timer chip, we will discuss each of them now.

Pin 5. Conrol Pin: The control pin is connected from the negative input pin of comparator one.

Consider for a case the voltage between VCC and GROUND is 9v. Because of the voltage divider in the chip as observed in figure3 of page8, The voltage at the control pin will be VCC*2/3 (for VCC = 9, pin voltage=9*2/3=6V).

The function of this pin to give the user the directly control over first comparator. As shown in above figure the output of comparator one is fed to the reset of flip-flop. At this pin we can put a different voltage, say if we connect it to +8v. Now what happens is, the THRESHOLD pin voltage must reach +8V to reset the flip-flop and to drag the output down.

For normal case, the V-out will go low once the capacitor gets charge up to 2/3VCC (+6V for 9V supply). Now since we put up a different voltage at control pin (comparator one negative or reset comparator).

Capacitor should charge until its voltage reaches the control pin voltage. Because of this force capacitor charging, the turn on time and turn off time of signal changes. So the output experiences a different turn on torn off ration.

Normally this pin is pulled down with a capacitor. To avoid unwanted noise interference with the working.

Pin 2. TRIGGER: Trigger pin is dragged from the negative input of comparator two. The comparator two output is connected to SET pin of flip-flop.

With the comparator two output high we get high voltage at the timer output. So we can say the trigger pin controls timer output.

Now here what to observe is, low voltage at the trigger pin forces the output voltage high, since it is at inverting input of second comparator. The voltage at the trigger pin must go below VCC*1/3 (with VCC 9v as assumed, VCC*(1/3)=9*(1/3)=3V). So the voltage at the trigger pin must go below 3V (for a 9v supply) for the output of timer to go high.

If this pin is connected to ground, the output will be always high.

Pin 6. THRESHOLD: Threshold pin voltage determines when to reset the flip-flop in the timer. The threshold pin is drawn from positive input of comparator1.

Here the voltage difference between THRESOLD pin and CONTROL pin determines the comparator 2 output and so the reset logic. If the voltage difference is positive the flip-flop gets resetted and output goes low. If the difference in negative, the logic at SET pin determines the output.

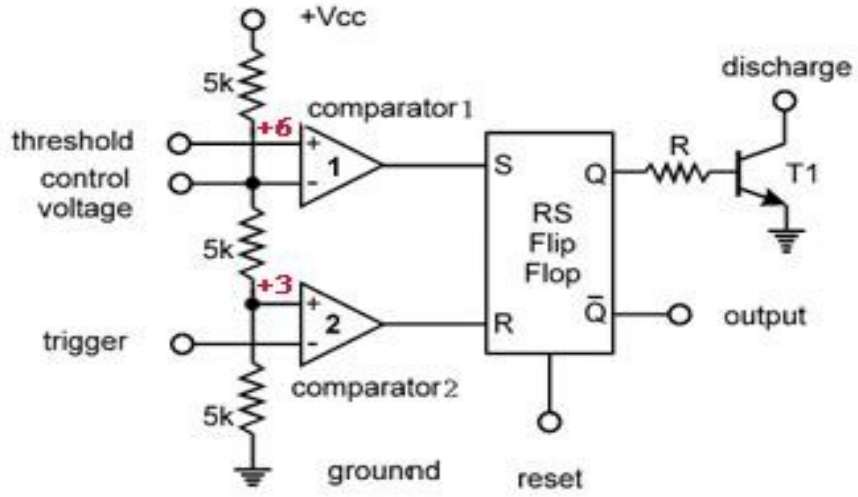
If the control pin is open. Then a voltage equal to or greater than VCC*(2/3) (i.e.6V for a 9V supply) will reset the flip-flop. So the output goes low.

So we can conclude that THRESHOLD pin voltage determines when the output should go low, when the control pin is open.

Pin 7. DISCHARGE: This pin is drawn from the open collector of transistor. Since the transistor (on which discharge pin got taken, Q1) got its base connected to Qbar. Whenever the ouput goes low or the flip-flop gets resetted, the discharge pin is pulled to ground. Because Qbar will be high when Q is low, So the transistor Q1 gets turns ON as base of transistor got power.

This pin usually discharges capacitor in ASTABLE configuration, so the name DISCHARGE.

INTERNAL DIAGRAM OF 555 TIMER

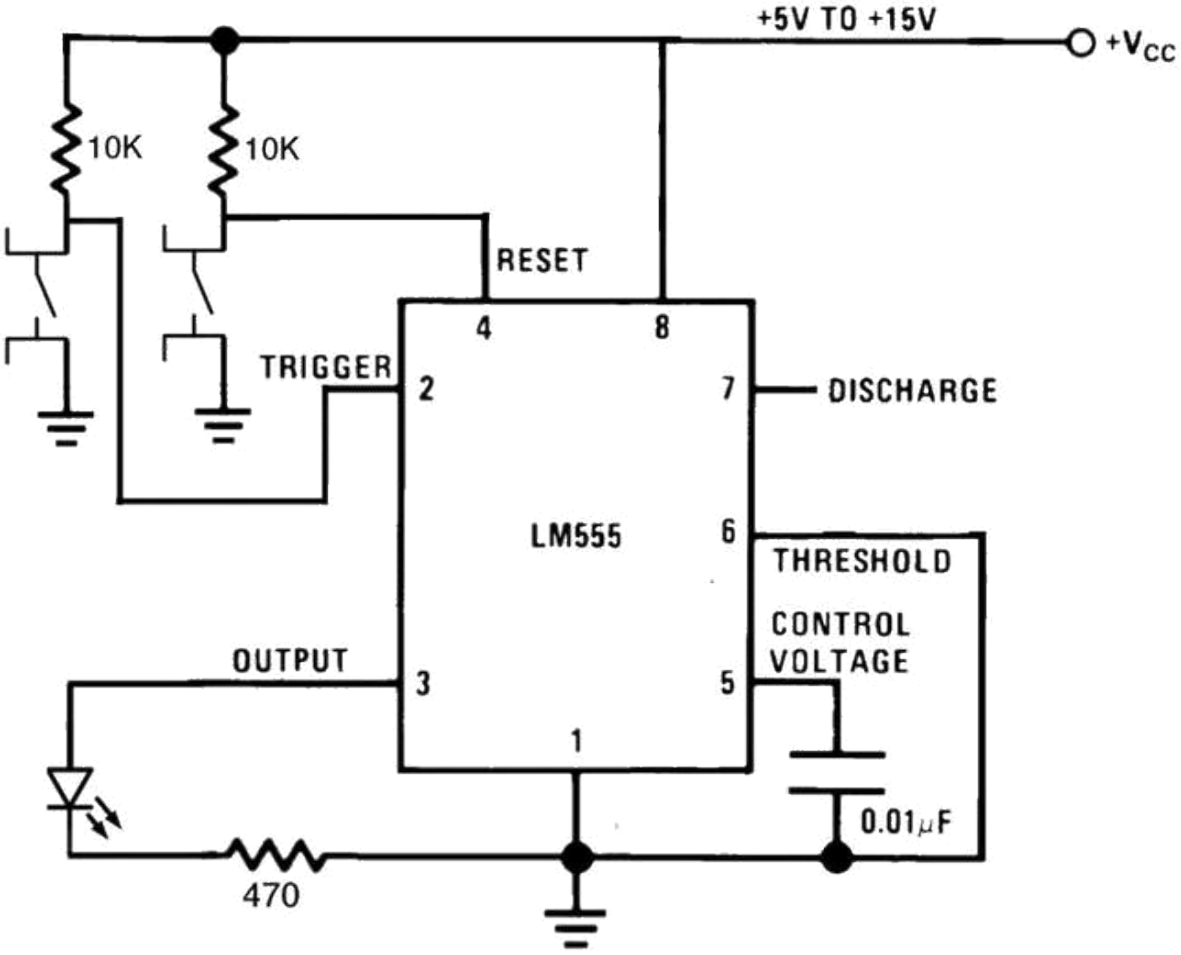


BISTABLE MODE OF THE 555 TIMER

The 555 timer in bistable mode is also known as a flip-flop circuit. A flip-flop circuit alternates between two stable states, in this case the output of electrical current from the output pin. Unlike the monostable mode and astable modes, bistable mode doesn't need a resistor and capacitor to set the timing of the circuit. In fact there is no timing in this circuit. There are only two stable states (on and off) controlled directly by the trigger pin and reset pin.

HOW BISTABLE MODE WORKS :-

The bistable mode of the 555 timer with an LED and push buttons connected to the trigger pin and reset pin. Pressing the trigger button once will make the LED turn on and stay on. Pressing the reset button will make the LED turn off and stay off.



Pressing the trigger button allows current to flow from Vcc to ground, which causes the voltage at the trigger pin to drop. Same as in monostable, when the trigger pin is at a low voltage, the output gets switched on and the LED lights up. The output stays on until the voltage at the threshold pin goes above 2/3 Vcc. Since the threshold pin is wired to ground in this circuit, it never reaches 2/3 Vcc, so the output stays on indefinitely.

Now if the reset button is pressed, the voltage at the reset pin flows to ground and the pin goes low. When the reset pin goes low, the output is switched off.

PUSH BUTTON OPERATION :-

A push button switch is a small, sealed mechanism that completes an electric circuit when you press on it. When it's on, a small metal spring inside makes contact with two wires, allowing electricity to flow. When it's off, the spring retracts, contact is interrupted, and current won't flow.

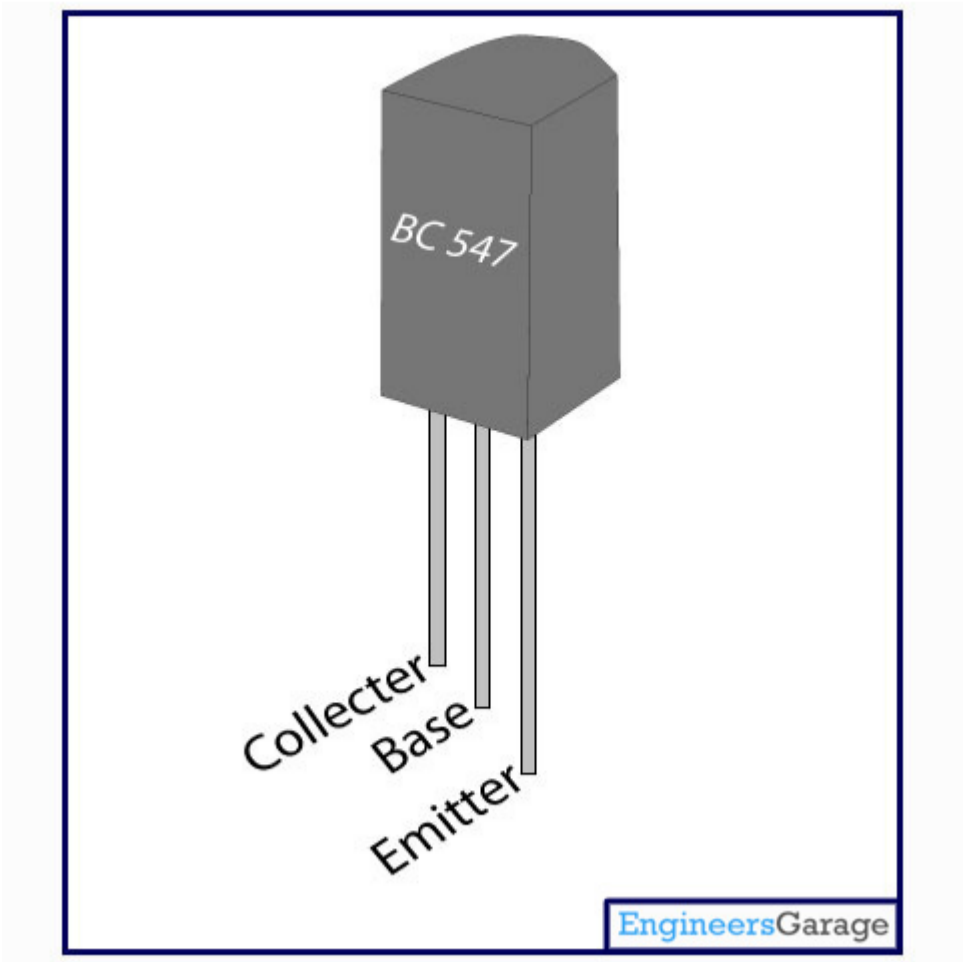
TRANSISTOR BC547 :-

BC547 is an NPN bi-polar junction transistor. A transistor, stands for transfer of resistance, is commonly used to amplify current. A small current at its base controls a larger current at collector & emitter terminals.

BC547 is mainly used for amplification and switching purposes. It has a maximum current gain of 800. Its equivalent transistors are BC548 and BC549.

The transistor terminals require a fixed DC voltage to operate in the desired region of its characteristic curves. This is known as the biasing. For amplification applications, the transistor is biased such that it is partly on for all input conditions. The input signal at base is amplified and taken at the emitter. BC547 is used in common emitter configuration for amplifiers. The voltage divider is the commonly used biasing mode. For switching applications, transistor is biased so that it remains fully on if there is a signal at its base. In the absence of base signal, it gets completely off.

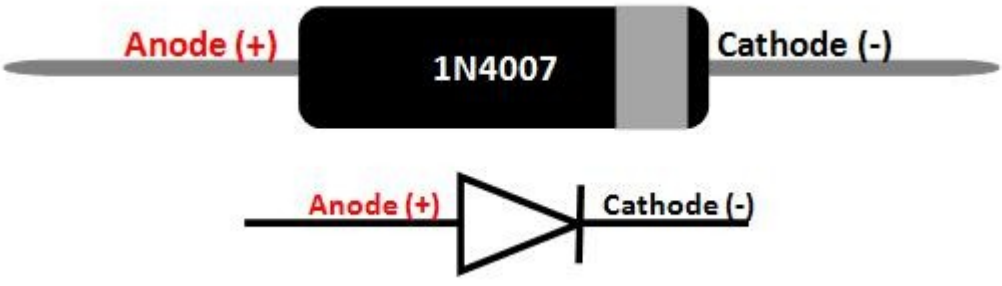
Pin Diagram:



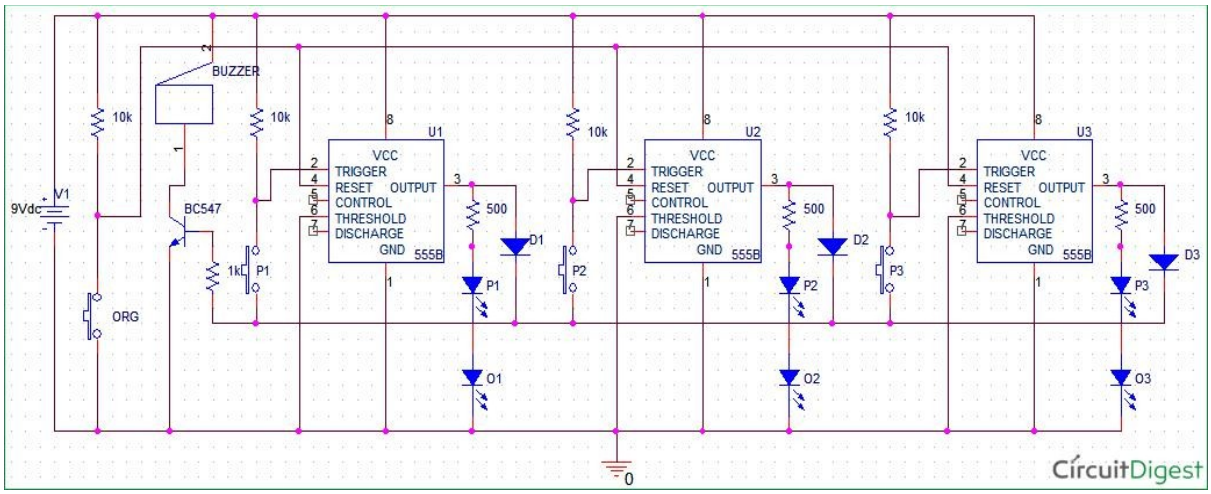
Pin Configuration:

Pin No.	Pin Name	Description

1	Anode	Current always Enters through Anode
2	Cathode	Current always Exits through Cathode



Fastest First Swimmer Circuit Diagram and Explanation:



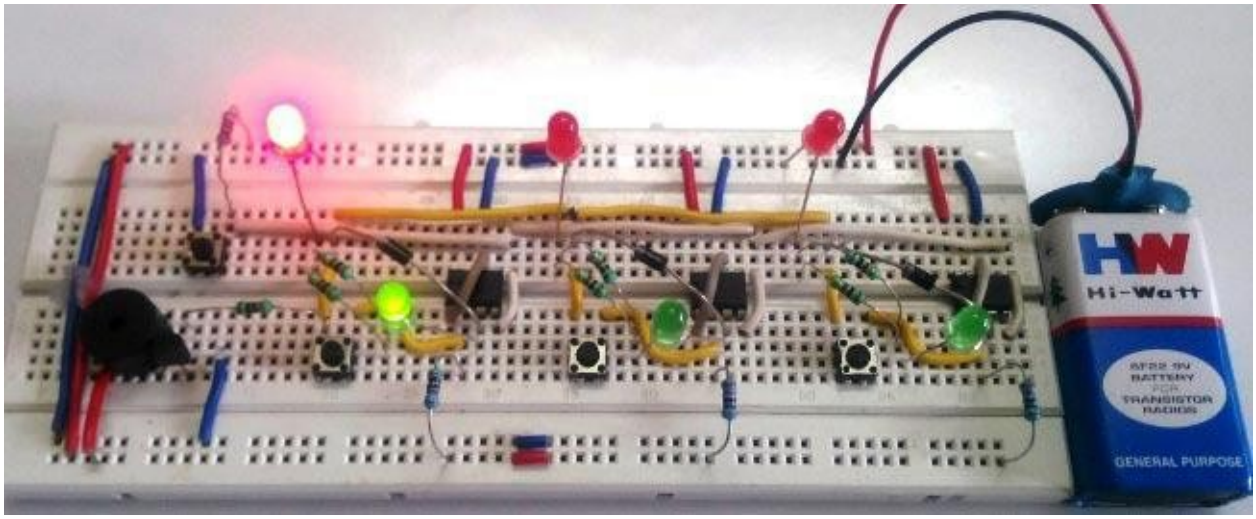
Here in the circuit diagram of the Fastest Swimmer First circuit using 555 IC, we have used three 555 timer IC in bistable configuration. The important part is each 555 IC will have their own stable state controlled by separate buttons which will be accessed by the participants. Another single button controls the other stable state of the all the timer ICs in common which is accessed by the organizer to reset the entire circuit. When any of the buttons P1, P2, P3 is pressed the corresponding TRIGGER pin gets low and the timer shifts its stable state and the output pin of the corresponding timer goes high. And the Green LED of corresponding Participant turns on and buzzer starts beeping.

The operation is that when the first stable state of any one timer is set, it disables the remaining timers. This is because the forward biased diode connected to output pin of the set timers

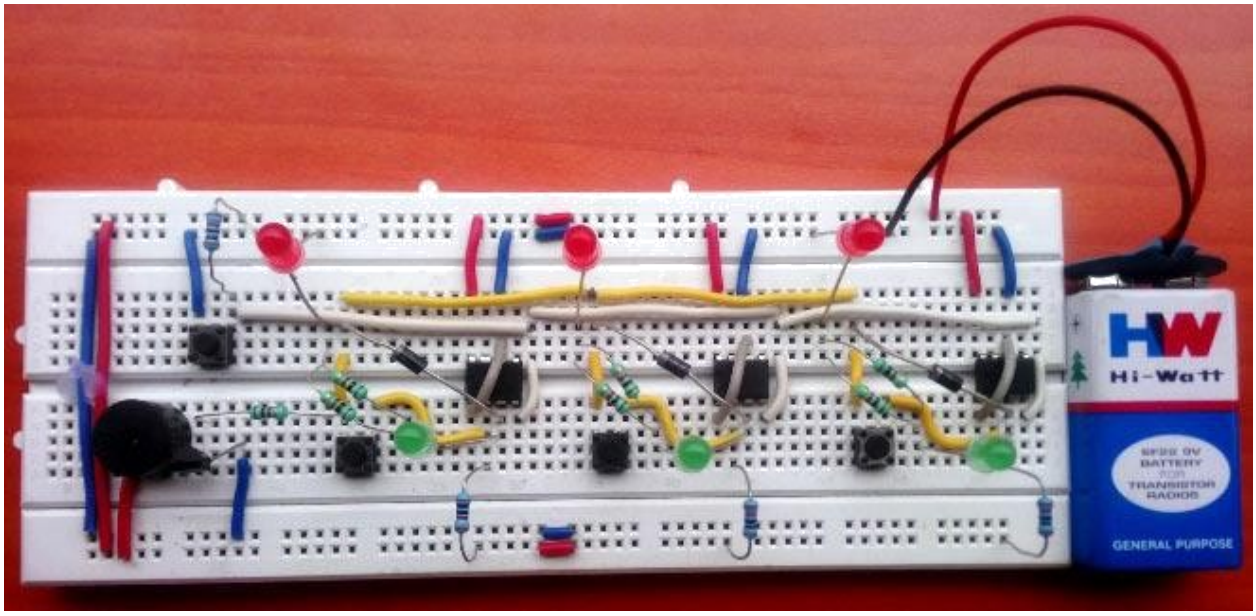
gets forward biased making the remaining button terminals go high. Hence, even if the other buttons are pressed after this, the corresponding timer's pin sees only high signal. Hence, the buttons work only after resetting the entire circuit. The buzzer is controlled using NPN transistorBC547 whose control signal is the common TRIGGER to which buttons are connected. Also, the buttons are grounded through internal diode of transistor.

Working of FSF Circuit:

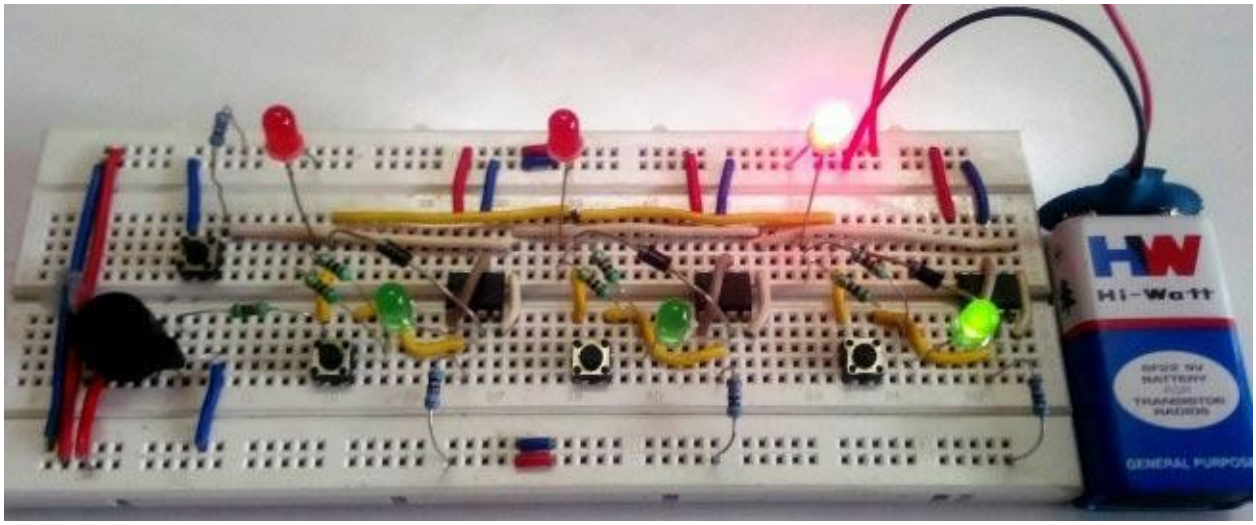
The whole circuit is powered by a 9V battery. Initially the circuit is in RESET condition and waiting for a TRIGGER signal. So, as soon the participant presses the button the corresponding timer changes its state and the output goes high and the buzzer sounds to indicate the button press. Below picture indicates that the button P1 is pressed and the remaining buttons will be disabled.



Now when the RESET button ORG is pressed the circuit goes to initial state and again waits for next TRIGGER.



The GREEN LED is to indicate the participant that he/she has pressed first. The RED LED is to indicate the organizer about the first person to press the button. Now when the third participant presses the button the corresponding LED goes high and the buzzer will sound.



This process can be continued to any number of times. If the buzzer is not needed in the circuit, the transistor BC547 and buzzer can be eliminated. But, the resistor connected to base of the transistor should be grounded directly. Or if anyone wants to

add buzzer on each participant side then it can be added with a NPN transistor on PIN 3 of each 555 timer.

Conclusion :-

Therefore when the person presses the switch first then the corresponding LED blinks and buzzer rings which indicates the person who came first by disabling the other's LEDs.