DIGITAL STOPWATCH

EM DEV CHARAN TESTED

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The time plays a vital role in everyone's life. Somebody may loose one's life because of delay of even one second .The stopwatch is not new for us but commonly used mechanical stopwatches does not guarantee accuracy , precision and other so many drawbacks are there i.e. size.. Now a days there is revolution in digital field hence why don't we have a digital aid entitled "digital stopwatch" to measure time duration among several events. Many circuits of stopwatches have been published in so many electronics related magazines, but the circuit shown here is the cheapest, simple and easy to assemble. This can be used to count from 1 sec to 9999999999 seconds. (depends on display panel, generally 10 digit calculator is commonly used.)

CIRCUIT DESCRIPTION:

The main heart of the digital stopwatch is the timer IC 555 used as a pulse generator in astable mode to produce the pulses of 1 second duration or 1Hz frequency. The pulse duration can be varied by changing the value of variable resistor VR2. The output of pulse generator unit is to control the operation of the switching unit. The pulse duration depends on R1 and R2 and C value as per the relation given below.

Total time period = 0.69(R1+2R2) C.

The function of the switching module is to switch ON and OFF to the opt-coupler. The opto-coupler is the mediator used in many electronic designs to couple one form of energy to another form of energy. i.e. I/P =>electrical and O/P => mechanical switching.

Generally we used to press a button to switch on any appliances means that we make contact between two points to complete the circuit. Instead of pressing manually, if we have a switching element which makes contacts between two points which is equivalent to manual operation This simple concept is utilized to implement this design.

Instead of pressing '=' button of calculator, opto-coupler makes contact between two points. The main heart of the switching module is OPTO-COUPLER. The opto-coupler comprises of LED and photo transistor which are well aligned to couple the light. Whenever the LED is ON ,photo transistor starts working and this state is similar to the CLOSED position of the switch. In off state it is just like open circuit

LED ON PHOTO TRANSISTOR ON EQUIVALENT TO ON STATUS
LED OFF PHOTO TRANSISTOR OFF EQUIVALENT TO OFF STATUS

A very simple concept utilised in calculator that is ,If we want to add same number again and again then we press that number and '+' button two times. Then if we press the '=' button every time then same number get added and so on. In this design also before starting the operation , we have to press '1' & '+' button and then automatically '=' button is operated through opto-coupler and digit '1' will be added in sum every time. This is for calculator as a display device only. In segment display unit there is no need to press such thing.
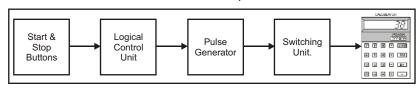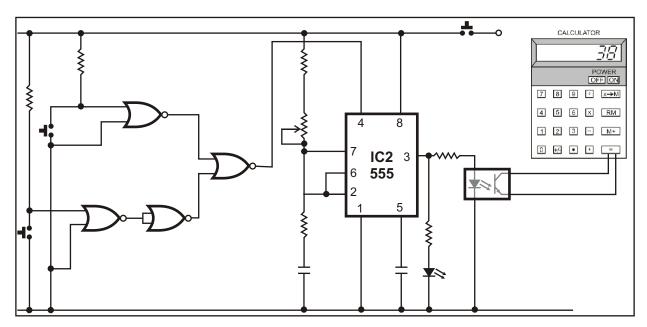
OPTIONAL DISPLAY UNIT :

This is an optional circuit those who do not want to use LCD display they can use this circuit to interface with pulse generator. A simple display unit using IC 74C926 IC which comprises a 4 digit counter and source driver for 7 segment display. It has internal multiplexer with four multiplexed outputs. The multiplexing circuit has its own free running oscillator and requires no external clock pulse. This IC has input protection circuit consisting of a series resistor and a diode connected to the ground. The IC 74C926 features a wide range of supply from 3V to 6V with guaranteed noise margin of 1V.

Instead of connecting output of pulse generator(IC555) to the opto-coupler that should be connected to the input terminal (pin no.12) of the display unit (IC 74C926). As per the pulse rate, display unit will display the count on seven segments.

Power Supply:

The power supply consists of step down transformer X1 of 7.5-0 &500 MA ratings. A Bridge rectifier (using diodes 1N4007) is used to convert

AC into DC, a capacitor of 1000 f for filtering, two regulator IC 7805 is used to supply regulated voltage to Logic control unit and pulse generator respectively.

CONSTRUCTION:

1. The entire circuit can be fabricated on general purpose PCB
2. For easy replacement of ICs, IC sockets may be used.
3. The heat sinks may be used for both the regulator ICs.
4. Observe PCB for dry joints, solder splashes between tracks and then connect transformer supply.

TESTING, ADJUSTMENT& PRECAUTIONS:

1. Adjust the value of VR precisely to get pulse of 1 sec or 1 HZ frequency.
2. Before connecting to optocoupler, please short the two wires which are connected to The calculator and see the no. is incremented by one for every short ckt. Then connect to the opto coupler
3. Press digit 1 once and '+' twice and then '='once then unit is ready for Counting..
4. Press switch S1 to excite the ckt..
5. Press switches S3 to start and S2 to stop.
6. Actual elapsed time = (time displayed on calculator -1)sec..

APPLICATIONS:

1. For Experimental purpose in Educational institute,
2. Industries,
3. Cultural Events like JUST A MINUTE (JAM)
4. Sports
5. Other similar activities.

In this way this circuit has number of applications in various fields. The total cost of circuit is not more than Rs. 100 (Optional display unit is not considered).

NOTE: The display unit is a calculator , so in order to make connections to '='(Equal to) button of calculator ,choose a calculator which has hard PCB. I have used CASIO pocket calculator for testing.

R3-R6 = 1K
R7-R13 = 56
T1-T4 = SL100
DIS1-DIS4 = LT543

L

X1

230V AC
50Hz

N

D1-D4 = 1N4001

D1   D2

D3   D4

IN

IC4
7805
1   3
2

OUT

+5V

COM

C3
1000µ
25V

C4
100µ
25V

GND

X1 = 230V AC PRIMARY TO 7.5V AC, 500mA
SECONDARY TRANSFORMER