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MISSING PULSE DETECTOR

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Abstract—As a signal goes through a rapid shift from base to higher value and after some period returns back to base value from higher value. It is considered as a pulse signal. A Missing Pulse Detector Circuit is needed to identify such missed pulses when any of the pulses in this pulse chain do not occur that have the predefined interval duration. The detector circuit is capable of delivering notification of missed pulses.

Keywords—NE555, TRI, THRS,

I. INTRODUCTION

The basic characteristic of a pulse is a sudden, brief shift in the amplitude of any signal from its baseline value to a greater or lower value, followed by a quick return to the baseline value. In terms of medical science, pulses (heartbeats) are particularly helpful for detecting a patient with cardiac abnormalities like arrhythmia, in which the patient has an abnormal heart when some of the heart beats fail to occur and have a predetermined interval of time. Therefore, it is necessary to build the prototype so that any such missed beats are caught.

An NE555 timer IC connected as shown here can detect a missing pulse or abnormally long period between two consecutive pulses in a train of pulses. Such circuits can be used to detect the intermittent firing of the spark plug of an automobile or to monitor the heartbeat of a sick patient.

The 555 Timer Oscillator, sometimes known as the "555 Timer," is one such device that has been around since the early days of ICs and has in turn become something of an industry "standard."

The three internally linked 5k resistors that the basic 555 timer employs to create the reference voltages for the two comparators are where it gets its name. The 555 timer IC is a relatively affordable, well-liked, and practical precision timing device that can function as either a relaxation oscillator creating a sequence of steady waveforms with variable

duty cycles from 50 - 100% or as a basic timer to create single pulses or extended time delays.

II. PROPOSED ALGORITHM

• HARDWARE/SOFTWARE REQUIREMENTS:

1. Breadboard
2. 555 timer IC
3. 2 pcs 10k resistors
4. BC337 NPN Bipolar Junction Transistor

5. Single strand wires for the connection in the breadboard.
6. 0.01uF ceramic disc capacitor
7. 0.1uF ceramic disc capacitor
8. Voltage source of 12 volt / 500 mA

• CONCEPTS/WORKING PRINCIPLE :

NE555 :

Three 5 k resistors are used to split the input voltage in three, which is how the 555 timer operates. These voltages are compared by two comparators to the input voltage, and the result sets or resets a flip-flop.

You can see three 5 k transistors between VCC and GND at the top of the figure.

The VCC voltage is divided in half by these resistors. Two triangles are present beneath the resistors. These are comparison tools. The output of a comparator is high or low depending on whether the input indicated with + or has a greater voltage.

Each pin of the NE555 is responsible for the following actions and tasks:

Pin 1 - Ground (GND)

This pin is connected to circuit ground.

Pin 2 - Trigger (TRI)

The output (pin 3) goes high when a brief low voltage (less than 1/3 the supply voltage) is provided to the Trigger input. Up until a high voltage is provided to the Threshold input, the output will remain high (pin 6).

Pin 3 – Output (OUT)

The voltage will be around zero volts in the output low condition. The voltage will be 1.7V lower in the output high state than the supply voltage. For instance, the output high voltage will be 3.3 volts if the source voltage is 5 volts. Up to 200 mA can be sourced or sunk at the output (maximum depends on supply voltage).

Pin 4 – Reset (RES)

The output (pin 3) will become low if the reset pin receives a low voltage (less than 0.7V). When not in use, this input should still be linked to Vcc.

Pin 5 – Control voltage (CON)

Through the control input, which is internally set to 2/3 the supply voltage, you can adjust the threshold voltage (pin 6). It may be adjusted between 45% and 90% of the source voltage. This gives you the option to change the output frequency in astable mode or the duration of the output pulse

in monostable mode. It is advised that this input be linked to circuit ground through a 0.01uF capacitor while not in use.

Pin 6 – Threshold (TRE)

The Threshold input is used to monitor the voltage across the timing capacitor in both astable and monostable modes. The output will change from high to low when the voltage at this input exceeds the threshold value.

Pin 7 – Discharge (DIS)

When the timing capacitor's voltage is higher than the threshold level. Through this input, the timing capacitor is drained.

Pin 8 – Supply voltage (VCC)

The positive supply voltage terminal is located here. The typical supply voltage range is +5V to +15V. In either astable or monostable mode, the RC timing interval will not fluctuate much throughout the supply voltage range (around 0.1%)

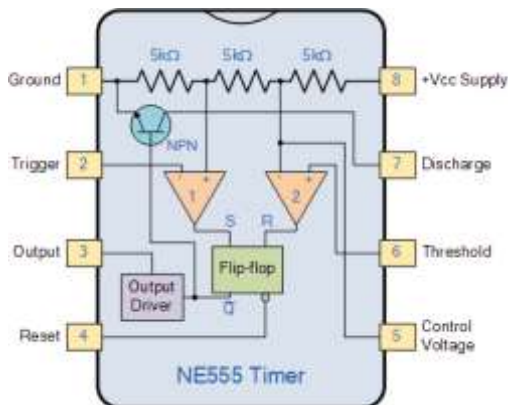


Fig. 1. NE555 model



Fig. 2 NE555 Device

Design algorithm –

Missing Pulse Detector:

The duration of the monostable mode is determined by the in-circuit R2 and C1 values.

Over the C1 capacitor is placed a transistor BC337. The input signal is coupled with the transistor through a single 10k base resistor and wired directly to the IC 555 timer trigger pin.

While the input signal does not contain any missed pulses, the timer IC 555 transmits a square wave to the display.

Now a missing pulse arrives, the T1 transistor turns on, and the BC337 discharges the capacitor when the C1 condenser connects over it.

During this discharge phase, the RC oscillator does not have the right time period for the IC 555. As a result, the production is still high.

The values of the capacitor C1 and resistor R2 govern the timing of the circuitry.

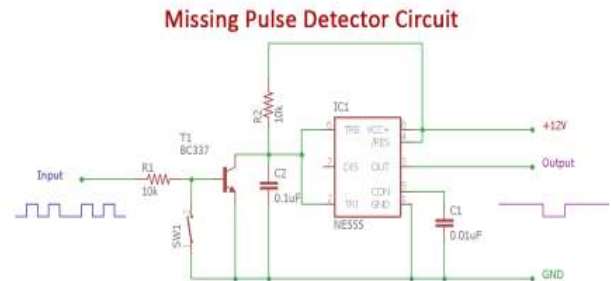


Fig. 3 Missing Pulse Detector Block Diagram

III. EXPERIMENT AND RESULT

APPROACH/METHODOLOGY/PROGRAMS:

This circuit is a missing pulse detector, i.e., it can be used to detect missing pulses in an incoming pulse train. The main component of this circuit is the 555 timer IC.

In this circuit, it is configured as a monostable multivibrator, i.e., a circuit which will output a single pulse every time it is 'triggered'.

A missing pulse will allow pin 3 to output a complete pulse. This means that it will change its state from 'high' to 'low' after the set pulse width has been attained.

Thus, a change in state of the output of this circuit signifies that it has detected a missing pulse in the pulse train arriving at the input.

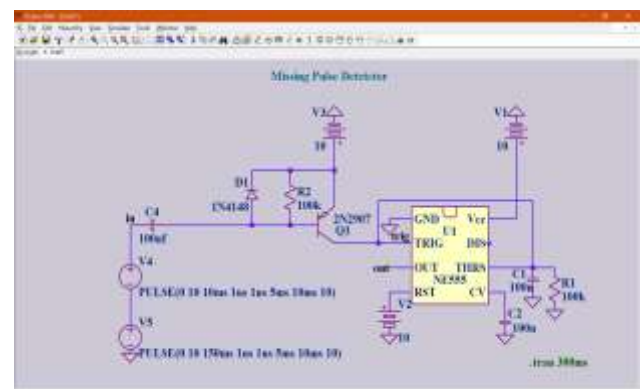


Fig. 4. LTspice Missing Pulse Detector Block diagram

OUTPUT:

The 555 basically functions here as a Set/Reset flip-flop controlled by the TRIG (/Set) and THRS (Reset) inputs.



With no input pulses, the Trig voltage is low, causing the output voltage to be high. An input pulse momentarily turns on Q1 at the pulse's falling edge, charging C1 to near V+. This is above the THRS trigger voltage (about $\frac{2}{3} V_+$), resetting the 555 Output to zero.

As long as pulses continue before C1 discharges below the TRIG trigger voltage (about $\frac{1}{3} V_+$), the Output stays low. An interruption in pulses allows C1 to discharge through R1 to below the TRIG trip point, setting the Output to high about 1.3 R1C1 time-constant after the falling edge of the last pulse. (The R1C1 time-constant can be changed, of course, to give the desired delay before the Output goes high after the last pulse).

The output then stays high until it receives another input pulse.

GRAPH:

On simulating the designed circuit, it is observed that in the graphs the circuit detects the missing pulse.

1. It is observed that the green waveform depicts the input voltage waveform.

2. The red waveform depicts the output waveform.

Here we can see clearly that the output waveform is high when there is a gap in the input pulse waveform. Hereby detecting the missing waveform in the input voltage.

This circuit also shows a high output till the pulse starts again.

3. The third waveform shows the triggered waveform. It goes high when a brief low voltage is provided to the Trigger input. Up until a high voltage is provided to the Threshold input, the output will remain high.

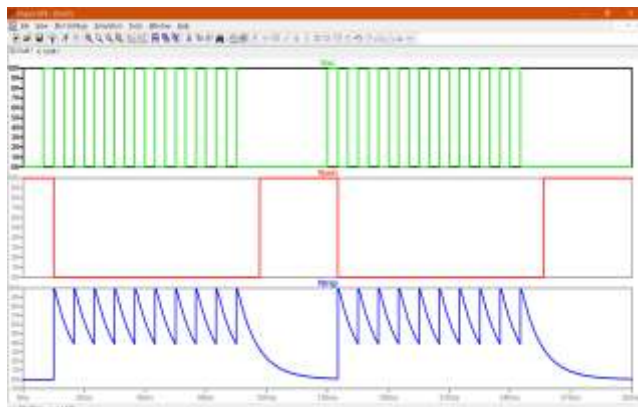


Fig. 5. Output Graph : Output voltage, Triggered voltage and Input voltage

IV.CONCLUSION

1. During operation, many electronics fan systems generate constant pulses. If the fan has been turned off or isn't operating properly, this circuit can quickly recognise it and sound the alert.
2. In the medical industry, heartbeat monitoring devices are employed with the missing pulse detection circuit. The

physicians could be alerted by this if the heartbeat is irregular.

3. This circuit can also be used to identify an interruption in the supply of alternating current.
4. In different signal source measuring-related operations, it may also be employed for half-wave or full-wave detection.
5. A missing pulse detector can be used in the industrial sector where quick detection is necessary.

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