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PROGRAMMABLE AUTOMATIC PNEUMATIC ULTRASONIC SENSOR BASED LOW COST BRAKING SYSTEM

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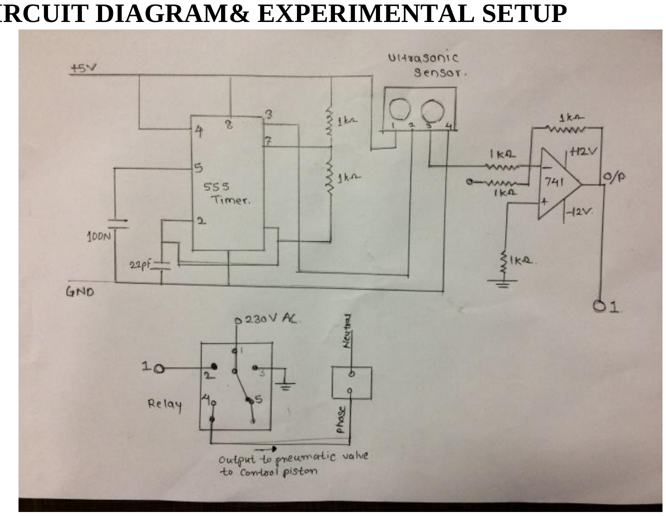
Abstract- In our day today life there are so many braking systems in vechicles.eg disk braking, drum braking, hydraulic braking etc. But all the braking systems are manual braking system. Sometimes we need urgent braking in spite of human reflexes, in that case above braking system are less reliable. Therefor there is a need to implement a braking system which can stop the vehicle despite of human reflexes. For this problem we have developed a non-programmable automatic pneumatic ultrasonic sensor based low cost braking system. Our main aim is that making a system to a very cost effective and can be implementing in any kind of vehicle. Such a system is very reliable and redudent.so with the help of system we can easily save human life.

1. INTRODUCTION

There are mainly 5 major components in PROGRAMMABLE AUTOMATIC PNEUMATICULTRASONIC SENSORBASED LOW COST BRAKING SYSTEM.

555 timer
Ultrasonic sensor
Operational amplifier
Direct acting solenoid valve normally closed
Relay

2. CIRCUIT DIAGRAM& EXPERIMENTAL SETUP



2.1 555 TIMER

The basic 555 timer have three internally connected 5kΩ resistors which it uses to generate the two comparators reference voltages. The 555 timer IC is a very cheap, popular and useful precision timing device which can act as either a simple timer to generate single pulses or long time delays, or as a relaxation oscillator producing a string of stabilized waveforms of varying duty cycles from 50 to 100%.

The 555 timer chip is extremely robust and stable 8-pin device that can be operated either as a very accurate Monostable, Bistable or AstableMultivibrator to produce a variety of applications such as one-shot or delay timers, pulse generation, LED and lamp flashers, alarms and tone generation, logic clocks, frequency division, power supplies and converters etc, in fact any circuit that requires some form of time control as the list is endless.

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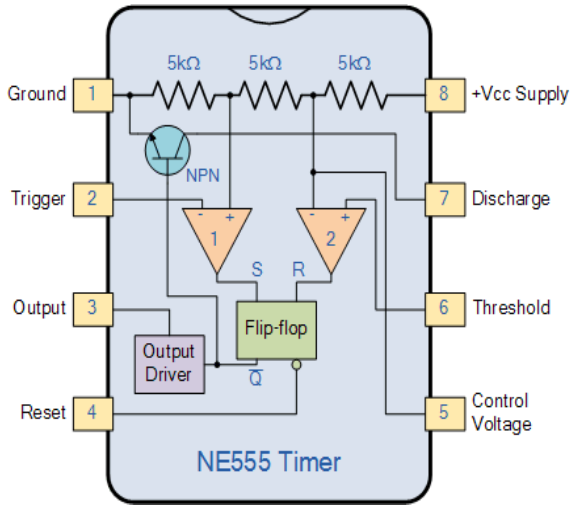
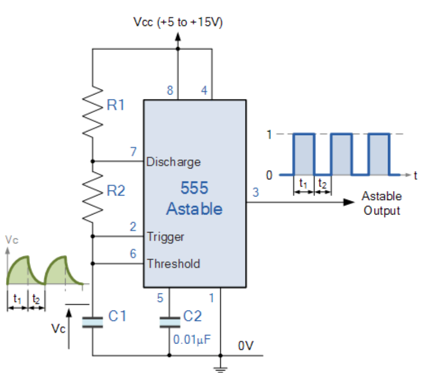
The single 555 Timer chip in its basic form is a Bipolar 8-pin mini Dual-in-line Package (DIP) device consisting of some 25 transistors, 2 diodes and about 16 resistors arranged to form two comparators, a flip-flop and a high current output stage .
A simplified “block diagram” representing the internal circuitry of the 555 timer is given below with a brief explanation of each of its connecting pins to help provide a clearer understanding of how it works.

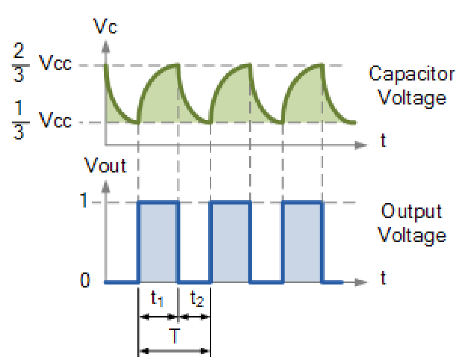
2.2 555 Timer Block Diagram



• Pin 1. – Ground, The ground pin connects the 555 timer to the negative (0v) supply rail.
• Pin 2. – Trigger, The negative input to comparator No 1. A negative pulse on this pin “sets” the internal Flip-flop when the voltage drops below 1/3Vcc causing the output to switch from a “LOW” to a “HIGH” state.
• Pin 3. – Output, The output pin can drive any TTL circuit and is capable of sourcing or sinking up to 200mA of current at an output voltage equal to approximately Vcc – 1.5V so small speakers, LEDs or motors can be connected directly to the output.
• Pin 4. – Reset, This pin is used to “reset” the internal Flip-flop controlling the state of the output, pin 3. This is an active-low input and is generally connected to a logic “1” level when not used to prevent any unwanted resetting of the output.
• Pin 5. – Control Voltage, This pin controls the timing of the 555 by overriding the 2/3Vcc level of the voltage divider network. By applying a voltage to this pin the width of the output signal can be varied independently of the RC timing network. When not used it is connected to ground via a 10nF capacitor to eliminate any noise.
• Pin 6. – Threshold, The positive input to comparator No 2. This pin is used to reset the Flip-flop when the voltage applied to it exceeds 2/3Vcc causing the output to switch from “HIGH” to “LOW” state. This pin connects directly to the RC timing circuit.
• Pin 7. – Discharge, The discharge pin is connected directly to the Collector of an internal NPN transistor which is used to “discharge” the timing capacitor to ground when the output at pin 3 switches “LOW”.
• Pin 8. – Supply +Vcc, This is the power supply pin and for general purpose TTL 555 timers is between 4.5V and 15V.

2.3 Basic astable 555 oscillator circuit

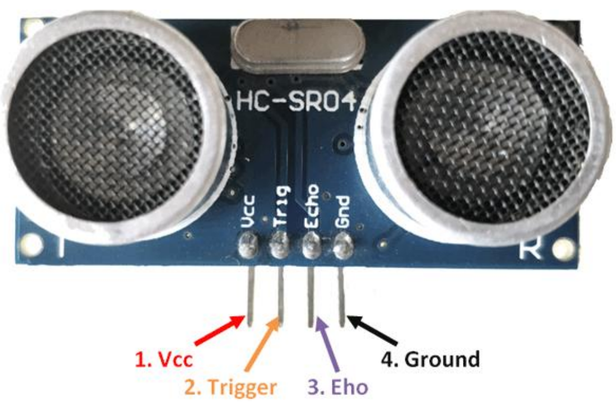




In the 555 Oscillator circuit above, pin 2 and pin 6 are connected together allowing the circuit to re-trigger itself on each and every cycle allowing it to operate as a free running oscillator. During each cycle capacitor, C charges up through both timing resistors, R1 and R2 but discharges itself only through resistor, R2 as the other side of R2 is connected to the discharge terminal, pin 7.
Then the capacitor charges up to 2/3Vcc (the upper comparator limit) which is determined by the 0.693(R1+R2)C combination and discharges itself down to 1/3Vcc (the lower comparator limit) determined by the 0.693(R2XC) combination. This results in an output waveform whose voltage level is approximately equal to Vcc – 1.5V and whose output "ON" and "OFF" time periods are determined by the capacitor and resistors combinations. The individual times required to complete one charge and discharge cycle of the output is therefore given as:astable 555 oscillator charge and discharge times
t1 = 0.693 (R1 + R2) C & t2 = 0.693 R2 C
Where, R is in Ω and C in Farads.
When connected as an astablemultivibrator, the output from the 555 Oscillator will continue indefinitely charging and discharging between 2/3Vcc and 1/3Vcc until the power supply is removed. As with the monostablemultivibrator these charge and discharge times and therefore the frequency are independent on the supply voltage.
The duration of one full timing cycle is therefore equal to the sum of the two individual times that the capacitor charges and discharges added together and is given as:
555 oscillator cycle time
T= t1 + t2= 0.693 (R1 + 2R2)C

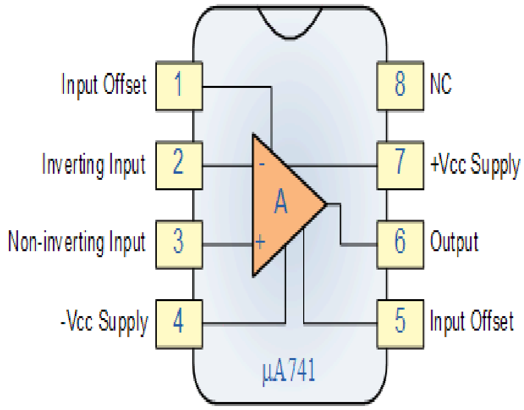
3. ULTRASONIC SENSOR

Ultrasonic sensor provides an easy method of distance measurement. This sensor is perfect for any number of applications that require you to perform measurements between moving or stationary objects.
Interfacing to a microcontroller is a snap. A single I/O pin is used to trigger an ultrasonic burst (well above human hearing) and then "listen" for the echo return pulse. The sensor measures the time required for the echo return, and returns this value to the microcontroller as a variable-width pulse via the same I/O pin.



4. OPERATIONAL AMPLIFIER

Operational amplifiers are linear devices that have all the properties required for nearly ideal DC amplification and are therefore used extensively in signal conditioning, filtering or to perform mathematical operations such as add, subtract, integration and differentiation.
An Operational Amplifier, or op-amp for short, is fundamentally a voltage amplifying device designed to be used with external feedback components such as resistors and capacitors between its output and input terminals. These feedback components determine the resulting function or "operation" of the amplifier and by virtue of the different feedback configurations whether resistive, capacitive or both, the amplifier can perform a variety of different operations, giving rise to its name of "Operational Amplifier".
An Operational Amplifier is basically a three-terminal device which consists of two high impedance inputs. One of the inputs is called the Inverting Input, marked with a negative or "minus" sign, (–). The other input is called the Non-inverting Input, marked with a positive or "plus" sign (+).
Equivalent Circuit of an Ideal Operational Amplifier

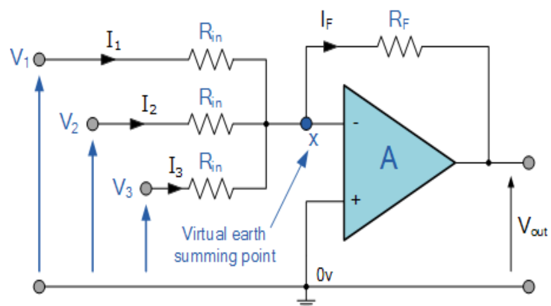


5. SUMMING AMPLIFIER CIRCUIT

In an operational amplifier circuit that will amplify each individual input voltage and produce an output voltage signal that is proportional to the algebraic "SUM" of the three individual input voltages V1, V2 and V3

The input signals are effectively isolated from each other by the "virtual earth" node at the inverting input of the op-amp. A direct voltage addition can also be obtained when all the resistances are of equal value and Rf is equal to Rin.

when the summing point is connected to the inverting input of the op-amp the circuit will produce the negative sum of any number of input voltages. When the summing point is connected to the non-inverting input of the op-amp, it will produce the positive sum of the input voltages.



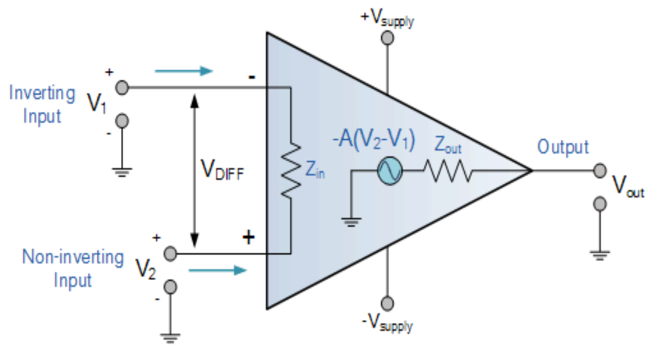
6. DIRECT ACTING SOLENOID VALVE NORMALLY CLOSED

This valve is a three-way, direct-acting valve and does not require a minimum differential pressure to operate. It can be configured as either normally open or normally closed. As shown in the diagrams below, when the coil is de-energized (left diagram), the plunger rests on the main orifice and is held in place by the plunger spring force, sealing the valve at the P port. During this time, the exhaust port is connected to the A port. When the coil is energized (right diagram), the solenoid lifts the plunger and allows the working medium to flow from the P to the A port, with the exhaust port sealed. All standard valves are supplied with Continuous Duty Coils of the proper class of insulation for the service indicated on the valve. It is normal for the coil temperature may become hot after being energized for extended periods. Smoke or burning odor indicates excessive coil temperature and the power should be disconnected to the coil immediately.

7. RELAY

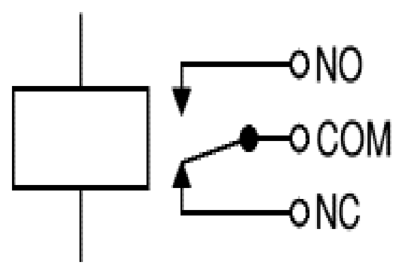
A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs cannot provide this current and transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA, enough to supply a relay coil directly.



8. WORKING

The 555 timer majorly works in astable mode .output terminal of 555 timers working as astable multi vibrator connected to input terminal of 4 pin ultrasonic sensor. During normal vehiclecondition, the ultrasonic sensor does not supply an output pulse and pneumatic brake is in off condition. When an obstacle comes near to ultrasonic sensor a pulse is generated at trigger input, this pulse is given to input terminal of op-amp which connected in summing application mode .because of input of op-amp the output pulse is generated in amplified form. The output is 5 v .the out of op-amp is given to coil of relay. When relay coil is energized the NO contact gets NC and AC supply given to valve which is required for its operation. For operational condition i.e. During ideal state of ultrasonic sensor the AC supply is given to NO contacts of relay.when supply gets to pneumatic valve, it passes compressed air which is generated with the help of compressor,given to the plunger to operate the breaking system .when obstacle is removed from front of ultrasonic sensor then & then only plunger RESET its initial stage.



9. CONCLUSION

We can implement this system not only in vehicles but also in industries where moving machinery's areused.This system is cost efficient and reliable.

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