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Speed Dependent Automatic Brake System Using Microcontroller

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Abstract: In this study, the design of Microcontroller based Speed dependent automatic braking system is described, The device detect obstacles in front of it and after measuring the distance and comparing it with the speed of the vehicles apply the brakes and stop the vehicles within safe distance to avoid collision. The designed system specifically makes use of microcontroller which can operate with use of minimal power, with such low power current consumption, it should be possible for system to work longer before needing to change power source (Battery), More devices rely on complex circuitry design which practically use more ower and are costly.

***Index Terms* -Microcontroller Based, automatic brake, sensor application, 8085.**

I. INTRODUCTION

An Automatic Braking Systems is important art of advanced automobile and is part of various safety technology integrated within the vehicle systems to warns the driver pre-collisions or apply brakes as per the safety parameters described within the system either to reduce the speed of the vehicles or apply the brakes prior to a collision with another vehicles, human or any obstacles to minimize the possible damage.

The systems uses sensor application such as infrared and ultrasonic technology to scan the possible obstacles in front and back of the vehicles and use braking systems to prevent the damage. Even though advanced vehicles has its own technology, Depending on the manufacturers, A systems uses sensors such as laser, radar or even video data to determine the possible object. In our system we have used sensor data from infrared sensor and ultrasonic sensor as starting data input to microcontroller to scan of possible obstacle in front of the vehicles.

It determines the distance between the moving vehicles and the object in front of it access relative speed of the vehicle by measuring the RPM of the wheels, If the systems concludes that there is significant speed distance, i. e speed of the objects on its path or the obstacles is within the unsafe distance from the moving vehicle, the systems applies the brake either to reduce speed or to stop the vehicle pre-collision and avoid the possible damage.

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II. COMPONENTS USED FOR MAKING OF SECURITY DEVICE

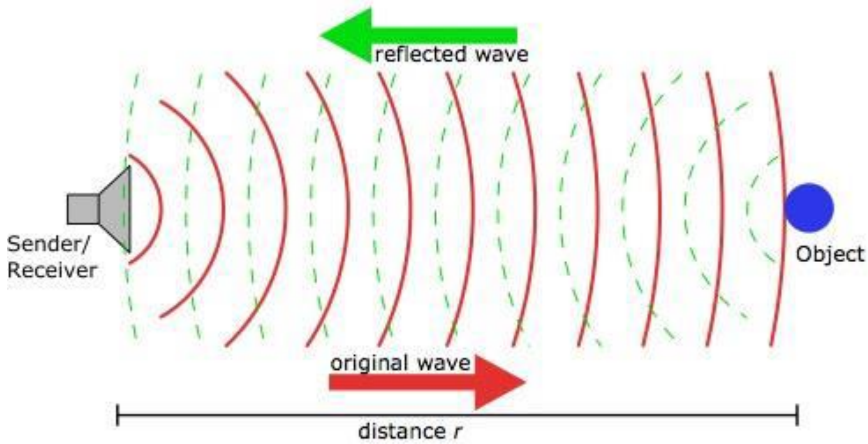
The project consists of following important parts:

2.1 Microcontroller (AT89S52)

AT89s52: The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry.

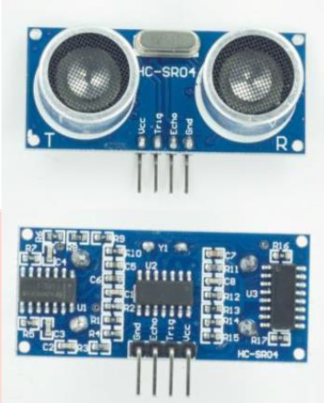
2.2: Ultrasonic Sensor

A ultrasonic sensors are devices that generate or sense ultrasound energy. They can be divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound, receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound.



In a similar way to radar and sonar, ultrasonic transducers are used in systems which evaluate targets by interpreting the reflected signals. For example, by measuring the time between sending a signal and receiving an echo the distance of an object can be calculated.

Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18 kHz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.



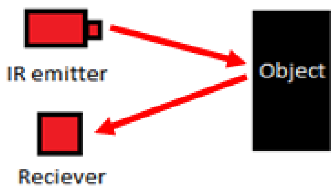
Ultrasound can also be used to make point-to-point distance measurements by transmitting and receiving discrete bursts of ultrasound between transducers. This technique is known as Sonomicrometry where the transit-time of the ultrasound signal is measured electronically (i.e. digitally) and converted mathematically to the distance between transducers assuming the speed of sound of the medium between the transducers is known. This method can be very precise in terms of temporal and spatial resolution because the time-of-flight measurement can be derived from tracking the same incident (received) waveform either by reference level or zero crossing. This enables the measurement resolution to far exceed the wavelength of the sound frequency generated by the transducers.

In general, Ultrasonic sensors are based on the measurement of the properties of acoustic waves with frequencies above the human audible range, often at roughly 40 kHz. They typically operate by generating a high-frequency pulse of sound, and then receiving and evaluating the properties of the echo pulse. Ultrasonic sensor module SRF-04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The module includes ultrasonic transmitters, receiver and control circuit in a single package.

2.3: Infrared Sensor Module.

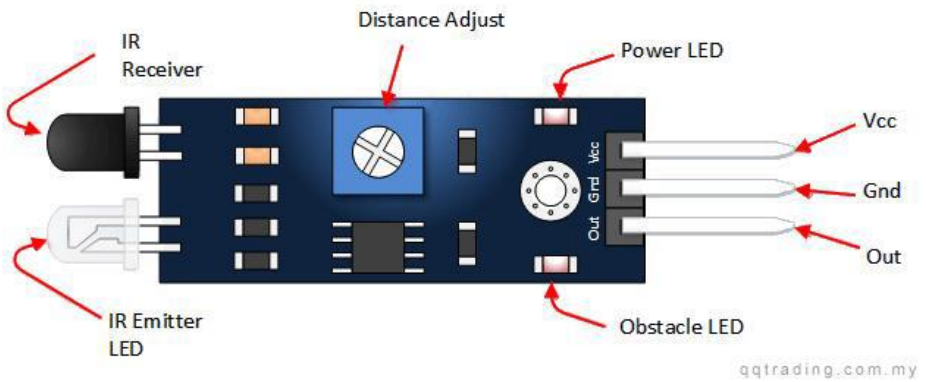
Active Infrared sensors are the types of infrared sensor that emit infrared radiation which is later received by the receiver. The IR is emitted by a IR Light Emitting Diode (LED) and received by photodiode, phototransistor or photoelectric cells. During the process of detection, the radiation is altered, between process of emission and receiving, by object of interest. The alteration of radiation causes change in received radiation in the receiver. This property is used to generate desired output with help of associated electronic circuit.

Sensors use reflective property of IR. The emitter emits an IR beam which is reflected by the object. The reflected IR is the detected by the receiver. The object causes change in the property of the reflected IR or the amount of IR received by the receiver varies. The degree of change is dependent on the reflectance of the object. Thus detecting the change in amount of received IR helps in figuring out the properties of object such as surface geography and reflectance.



Infrared Sensor is used as Digital RPM Sensor, A Digital RPM Meter is a measuring instrument which can measure the rotational speed of a rotary machine digitally. Industrial Name for Digital RPM meter is Tachometer.

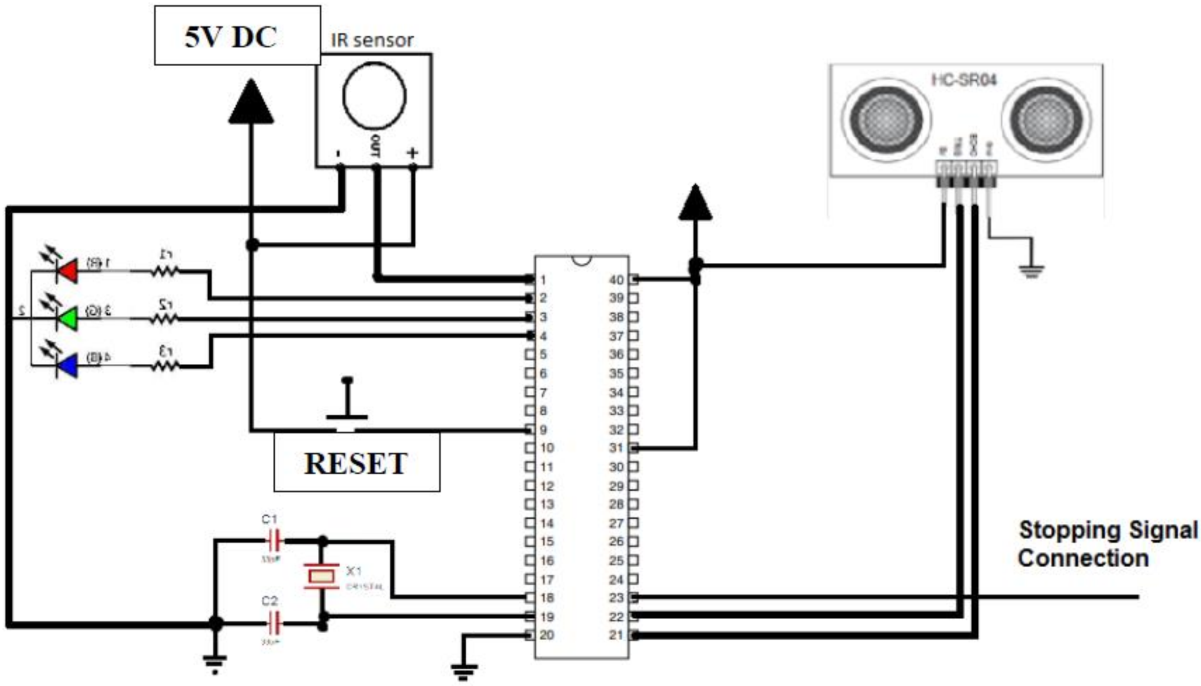
As IR transmits IR rays which reflect back to IR receiver and then IR Module generates an output or pulse which is detected by the microcontroller when we press start button. It counts continuously for 5 seconds. After 5 seconds microcontroller calculate RPM for a minute using formula.



Pin, Control Indicator	Description
Vcc	3.3 to 5 Vdc Supply Input
Gnd	Ground Input
Out	Output that goes low when obstacle is in range
Power LED	Illuminates when power is applied
Obstacle LED	Illuminates when obstacle is detected
Distance Adjust	Adjust detection distance. CCW decreases distance. CW increases distance.
IR Emitter	Infrared emitter LED
IR Receiver	Infrared receiver that signal transmitted by Infrared emitter.

III. Circuit Diagram.

Following Figure Shows Complete Circuitry



IV. WORKING OF THE DEVICES.

• Principle behind idea of project "the faster you go, the longer it takes to stop".

• When device is turned ON, Infrared sensor will start detecting the RPM of the vehicle wheels and will start sending signal to microprocessor for measuring speed of vehicle.

• A Reflective Strip on a wheel helps to reflect to IR receiver, which in turn gives spike in voltage received to microcontroller, this spiked is calculated by microcontroller for 5 seconds, Hence calculating the Rotation of wheels per minute which is used to measure speed of vehicle using the formula

• Speed = Circumference of Wheel (mm) x RPM / 16667 (km/h)

• According to Speed of the Vehicle, Microcontroller will adjust the range of Ultrasonic sensor as required.

• When Ultrasonic sensor detect any obstacles in travel path of the vehicle, It sends control signal to the microcontroller.

• When microcontroller detect Control Signal from Sensor. It will send signal to apply Break of the Vehicle and will also turn the LEDs indicator to warns the Driver.

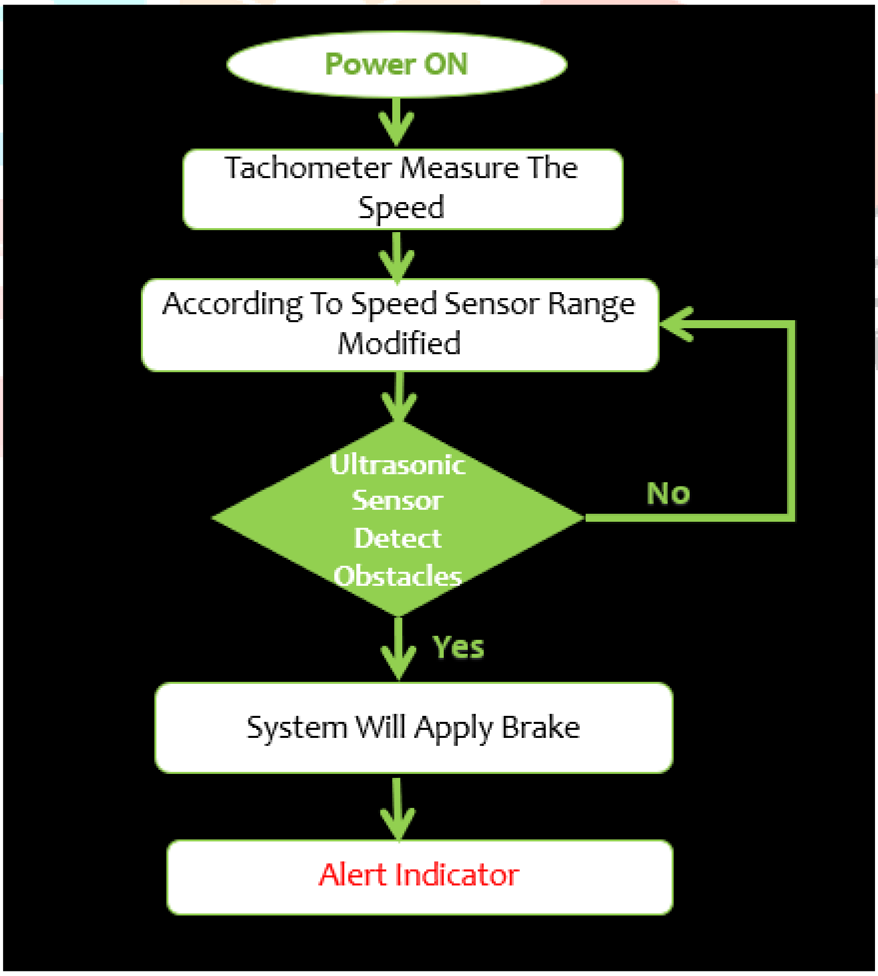
• According to the speed of the vehicle, the range of ultrasonic sensor is modified.

• For E.g. If vehicle is at a Speed of 45Km/Hr and it takes approx. 7 metres to completely stop the vehicle after applying the brake, the range of ultrasonic sensor will be modified for 7 metre, any obstacle detected at this point will be used by microcontroller to apply brake automatically.

• Similarly, at lower speed, Ultrasonic Sensor range will set it according to less Braking Distance.

• This Device will also assist incautious driver to avoid collision with minimal impact.

V. FLOW CHART.



VI. FEATURES AND ADVANTAGES.

- Low powered and cost effective.
- Easier to install, Low maintenance
- Sensors Range and Sensitivity can be customisable as per need up to from 2 cm upto 400cm
- Uses Less Energy to Operate. Can be operated with use of (+5 Volt DC).
- Easier to Expand. (Additional sensors can be installed to cover back area.)
- Flexibility. (more sensor can be added and can be customized easily by programming into microcontroller)

VII. PROJECT METHODOLOGY.

Components: Component Name and Quantity :

1. Microcontroller Atmel 89S52 *1
2. Ultrasonic Sensor*2
3. IR Receiver and Transmitter Module *1
4. Push Button *3
5. Resistance (390Ω*6, 330KΩ*1, 3.3KΩ*1, 820KΩ*1)
6. Capacitance (33 μF)*2
7. Crystal (11.0592 MHZ)*1
8. Transistor 2N2222 *3
9. LED*6
10. IC Base (40 Pin) *1,(18 Pin)*2
11. Female to Female/Male Connecting Wires/Headers.
12. DIY Circuit Board *2

Software Used:

13. Keil μVision v4.
14. XGOTL866II Plus.

VIII. APPENDIX.

Power Consumptions of Devices are as followed

OBS. NO.	DEVICES	PARAMETER	OPERATING VOLTAGE			UNIT
			Minimum	Operation On	Maximum	
1	Ultrasonic Sensor	VCC	4.5	4.81	5.0	V
		Range	--	Up to 4 Meters	--	Meter
		Temperature	-20	+30	+80	Celsius
2	IR Sensor Module	Supply Voltage	3	4.82	5	V
		Frequency Range	---	--	--	MHZ
		Data Output	--	1.29-1.33	--	V
3	Microcontroller AT89S52	VCC	4.5	4.85	5.5	V
		Input Pin: OFF State	--	0.13	--	V
		Input Pin: ON State	1.5		2.4	V

IX. ACKNOWLEDGMENT

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