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An Effective Obstacle Alert Parking System based on AT89S52 Microcontroller Using Ultrasonic Sensor

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ABSTRACT

On grounds of safety & security, automation & protection are the areas which find their applications in almost all the fields as they make human life more comfortable, economic & less rigid. This paper is about for developing a module which assists and warn a car driver it continuously detects the obstacle so as to avoid accidental situation while reversing the vehicle. This system can be used in vehicles, handy tool for disabled person, robotics, medical field, measurement, agriculture and industrial applications. These is a microcontroller based system in which an ultrasonic sensor transmits ultrasonic waves from its sensor head and once more receives the ultrasonic waves reflected from an obstacle and inform the microcontroller which signals the driver with an alarm and controls the vehicle by stopping it. This system endures mainly the obstacle detection module, which is interfaced with AT89S52 microcontroller. The hardware circuits of entire system and the success of several key technologies are considered, including transducer structure and parameters selection, design of the corresponding circuit and AT89S52 microcontroller which is used as systems main control unit.

Keywords: AT89S52 microcontroller, automation, embedded system, piezoelectric, ultrasonic sensor

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INTRODUCTION

The development in automobile innovation is presently pulling in electronics engineers. The reason is, presently automobile is not a mechanical system but rather gets to be intelligent automobile with an electromechanical system. Lately automobile are completely furnished with electronic systems and electronic sensors. One of them is Intelligent Vehicle Assistance System. The point of this system is to prevent accident with other vehicle or any protest while moving backward heading [1].

This system has been intended to help driver to prevent accident while stopping backward course. Separate sensors are utilized to detect the articles and used to recognize the distance. The system utilizes distance sensor as range finder, microcontroller to process calculation. It shows result on LCD screen and ready people on foot by buzzer and blazing LED lights. The system is enacted when the reverse gear is applied. At that point it persistently shows the distance of the obstacle on LCD show while turning around. It cautions the person on foot with flashing light and buzzer. At the point when the obstacle is close i.e. the distance amongst vehicle and obstruction is underneath limit esteem the system consequently applies brakes. It first searches down accessible stopping region. The microprocessor makes a calculation about car length and accessible space and

delivers a guide for parking, in processor memory.

PRINCIPLE AND SYSTEM

In this paper, we implemented an ultrasonic measurement system based on microcontroller AT89S52 ultrasonic sensor. The main aim of the system is detected and alerts the vehicle from the obstacle. System includes the following sections: ultrasonic circuit, echo reception circuit, a digital display circuit, alarm circuit, and microcontroller AT89S52.The use of ultrasound in the air and solid directional spread of the reflective properties, through the reception to send off its own reflection of the ultrasonic signal, according to ultrasound echo to send and receive time difference and the propagation velocity, measured the spread distance. When measurement, the sensor and the measured object is without direct contact, being able to clearly determine the stability of the measurement results. Ultrasonic distance meter works on a principle similar to radar or sonar which calculates attribution of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors produce high frequency sound waves and calculate the echo which is received back by the sensor. Sensors evaluate the time interval between sending the signal and receiving the echo to determine the distance to an object [2].

This innovation can be utilized for measuring: wind speed and direction (anemometer), completion of a tank and speed through air or water. For measuring speed or direction a device uses different detectors and assesses the speed from the relative distance to particulates noticeable all around or water. To gauge the measure of fluid in a tank, the sensor measures the separation to the surface of the liquid. Further applications include: humidifiers, sonar, medicinal ultrasonography, criminal cautions and non-ruinous testing [2].

Systems regularly utilize a transducer which creates sound waves in the ultrasonic range, above 18,000 hertz, by transforming electrical energy into sound, then after accepting the reverberate transform the sound waves into electrical energy which can be measured and showed. The innovation is constrained by the states of surfaces and the thickness or consistency of the material. For instance, from the surface of a liquid in a tank could distort a reading.

SYSTEM IMPLEMENTATION

System execution is separated in two sections. Initial segment is hardware part, which incorporates description of microcontroller, sensors, DC engine, LCD show, buzzer and LEDs. Second part is programming part, which is a program in installed C.

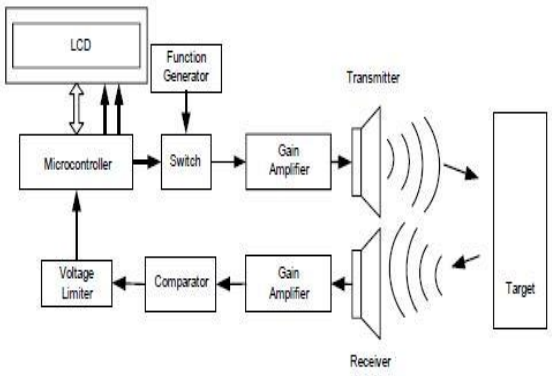

Fig. 1. *Block diagram of the system.*

Hardware Description

Figure 1 indicates block diagram of the system. Depiction of the hardware is given beneath. Microcontroller is performing out all computations and controlling all yield devices, for example, ringer, LCD show, DC engine and LED strip. Distance sensor is an input device.

1. MicrocontrollerAT89S52

The microcontroller forms the heart of an embedded system. The AT89S52 is the microcontroller used here which 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 non-volatile memory technology and is compatible with the industry-standard watchdog timer, two data pointers, three 16-bit timer/counters, six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes [6]. The pin diagram of the AT89S52 is shown in the Figure 2 microcontroller is always in the active mode, if the ultrasonic sensor senses an obstacle and founds a critical situation then the information is sent to the microcontroller [5]. The microcontroller first alerts the passengers inside the vehicle by display LCD and also it provokes the buzzer sound to warn the pedestrians and driver.

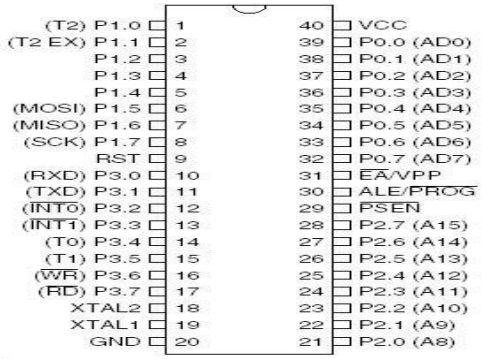

Fig. 2. *Pin diagram of microcontroller AT89S52.*

2. Ultrasonic Sensor HC SR-04

This Distance sensor is used to sense obstacle. Ultrasonic sensor is used in the system which senses the obstacle behind the vehicle by diffuses ultrasonic waves and receiving reflected waves. Number of sensors can varied according to width of the vehicle and necessity of precise measurement. Here Figure 3 shows the example of an ultrasonic HCSR-04 transducer which is also known as ultrasonic sensor [3].

Fig. 3. *Ultrasonic HCSR-04 transducer.*

The choice of sensor in ultrasonic measurement is particularly important. In the market, many different types of sensors such as laser ranging sensors, infrared distance sensors, and ultrasonic distance sensors are available. Laser ranging sensors and infrared distance measurement sensors are very high-precision ranging sensor, and some test range very small. They are mostly used in precision measuring tools, leading to high prices of the sensor. Ultrasonic sensor uses piezoelectric effect and is commonly made up of piezoelectric ceramic materials. As a result of the spread of ultrasound in the air there will be considerable decrement, the degree of attenuation is directly proportional to the level and frequency; and high frequency of high-resolution, it should choose a short distance measuring sensor with high frequency of high-resolution, it ought to pick a short separation measuring sensor with high frequency; the estimation of long-distance utilizes low-frequency sensors. With a ultrasonic transducer transmitting and accepting a blend of two functions, so just a couple of ultrasonic transducers then again transmit and get ultrasonic signs to finish the measurement requirements. The ultrasonic emission happens when an obstacle gets reflected, the reflected wave got by the collector. For whatever length of time that the deliberate ultrasonic wave reflected once again from the sending point to the time interval, then one can locate the ultrasonic wave from the launch service to the separation between the obstructions. Piezoelectric ultrasonic transducer [4] is the use of resonant piezoelectric crystal to work and Ultrasonic transducer within the two piezoelectric transducer chips and a board. When it's poles plus a pulse signal whose

frequency is equivalent to the natural oscillation frequency of piezoelectric chip, the piezoelectric wafer resonance happens, and advance the vibration of ultrasonic resonance board, when it is a ultrasonic generator; the other hand, inquired as to whether the two terminals no connected voltage, when the board gets the ultrasonic resonance, it will be for vibration suppression of piezoelectric chip, the mechanical energy is changed over to electrical signs, then it gets to be ultrasonic receiver transducer. Ultrasonic emission transducer and receiver transducer is somewhat unique in structure. Ultrasonic sensor model selects general-purpose sensor T-40. Its parameter is as follows. The central frequency is 40 KHz. The sensitivity is 1.0mV. The insulation impedance is 100K ohm. The max input voltage is 140V. The temperature ranges from -30 to 85 centigrade degree. The max cable length is 8 meter. All data come from its manual [3].

3. Buzzer

A buzzer or beeper is an audio signaling device. The buzzer is utilized in the system to make a sound when the obstacle is very near. It is used to give alert signal to the driver as well as pedestrians.

4. LCD Display

Liquid crystal display is used to display messages about the distance between automobile vehicle and obstacle. The display is interfaced with microcontroller and the messages are programmable.

5. DC Motor with Motor Driver

DC motor is used to move a shaft. This shaft is used to stop the vehicle while reversing. The microcontroller is programmed such that DC motor will run and apply brakes when the distance between obstacle and vehicle is below the threshold value. The threshold value can be changed using microcontroller program.

6. LED Strip

Flashing LED strip is used to alert pedestrian when automobile vehicle is moving in reverse direction. The speed of flashing increases when distance between obstacle and vehicle decreases (Figures 4, 5).

Software Description

The system flow chart:

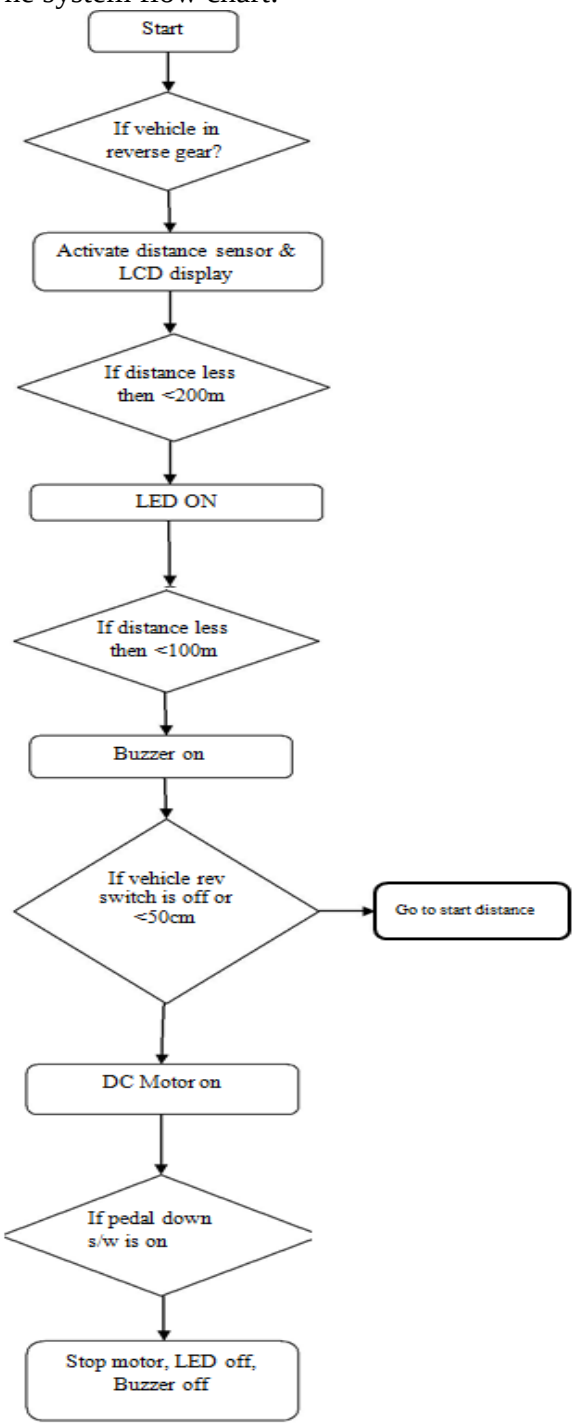

Fig. 4. *System flow chart.*

EMBEDDED C

An embedded system is utilized to perform a particular undertaking utilizing embedded software. This product can be created utilizing different programming languages. Be that as it may, installed C is notable on account of its adaptability, effortlessness, unwavering quality and versatility. Subsequent to building up the software it is cross complied utilizing Keil compiler before downloading. At that point the software is downloaded to microcontroller through a downloading tool, for example, universal programmer. Distance sensor is initiated when vehicle is backward rigging. Distance sensor ceaselessly detecting the separation amongst vehicle and obstruction. The distance is shown on LCD show. At the point when the distance is beneath 200 cm LED begins blazing and the frequency of glimmering continue expanding when the separation continue diminishing. At the point when the distance is underneath 100 cm buzzer is on. The DC engine is initiated when the distance is beneath 50 cm. At that point programmed brakes are connected utilizing shaft. That will stop the car. When car is not in reverse gear all the sensors are then deactivated [1].

An embedded system [6] is the one which is designed to perform a specific task and the embedded software rules the entire system.

This software for a particular embedded system could be developed using various embedded programming languages. But embedded C is the well-known embedded programming language.

Use of C in embedded systems is driven by following advantages

- It is small and reasonably simpler to learn, understand, program and debug.
- C Compilers are accessible for every single embedded device being used today, and there is a huge pool of experienced C developers.
- As C combines functionality of assembly language and features of high level languages, C is treated as a
- Middle - level computer language or high level assembly language.
- It is genuinely proficient.
- It supports access to I/O and gives simplicity of administration of vast implanted tasks.

Many of these choices are offered by other languages also, but what sets C apart from others like Pascal, FORTRAN, etc. is the fact that it is a middle level language; it gives direct hardware control without sacrificing benefits of high level languages.

Compared to other high level languages, C offers more flexibility because C is relatively small, structured language; it supports low-level bit-wise data manipulation.

Contrasted with low level computing construct, C Code composed is more reliable and scalable, more convenient between various stages (with some changes).Moreover, programs created in C are much less demanding to comprehend, keep up and troubleshoot. Additionally, as they can be created all the more rapidly, codes written in C offers better profitability. C depends on the theory, developers recognize what they are doing‟; just the goals are to be expressed unequivocally. It is simpler to compose great code in C and change over it to an effective get together code (utilizing astounding compilers) as opposed to composing a productive code in get together itself. Advantages of low level computing construct programming over C language are insignificant when we contrast the straightforwardness and which C projects are created by developers.

RESULTS

LCD Reading

Green light indicates Safe zone(>50cm)

Red light indicates danger zone(<50cm)

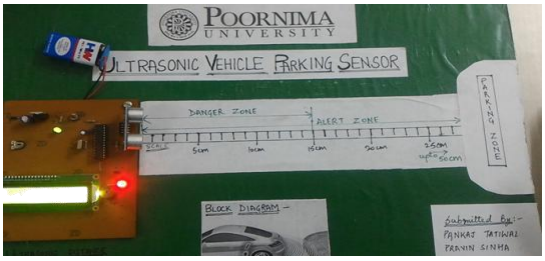

Fig. 5. *Utrasonic distance measurement system.*

Table 1 shows the measurement data with scale and ranger of ultrasonic transducer.

Table 1. *Measurement data with scale and ranger.*

Ranger	Scale
26 cm	29 cm
32 cm	34 cm
49 cm	49 cm
57 cm	68.5 cm

Table 2 shows the status of devices when the distance between vehicle and obstacles changes. It shows the results of changing the distance between vehicle and obstacles.

Table 2. *Results of changing the distance between vehicle and obstacles.*

Reverse Gear Applied	Distance	LED	Buzzer
No	-	OFF	OFF
Yes	≤200 cm	ON	OFF
Yes	≤100 cm	ON	OFF
Yes	≤50 cm	ON	ON

CONCLUSION

The target of this project was to plan and execute an Ultrasonic Obstruction Detection and Distance Measurement device. As depicted in this report a system is produced that can distinguish objects and ascertain the distance of the tracked object. As for the necessities for a ultrasonic rangefinder the followings can be closed.

- The system can recognize obstacle inside the detecting range.
- The system can compute the distance of the obstruction with adequate precision.
- This device has the ability to communicate with other fringe if utilized as an optional gadget.
- This can likewise speak with PC through its serial port.
- This offers a minimal effort and effective answer for non-contact sort remove estimations.

The Rangefinder has various applications. It can be utilized for programmed guided vehicles, situating of robots and in addition measuring nonspecific distances, fluid levels in tanks, and the profundity of snow banks. The device can serve as a movement identifier underway lines. The ultrasonic recognition run relates with size, figure, material and position of the object. The greater the reflector is, the better the reflectance is, and the more grounded the reflection signal. The ultrasonic distance measurement is an untouchable location mode.

Contrasted and else identification modes, it doesn't get tremendously impacted by beam, temperature and shading and so on, and it has the considerable capacity to adjust to different conditions and ambient conditions. A restricted target angle (it requires a close opposite surface) and large beam, which can make poor determination, appear to be the Rangefinders' only limitations.

Additionally there is a visually impaired zone and distance confinement in ultrasonic distance estimation. Regardless of these downsides, we observe the device's primary elements to be to a great degree valuable.

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