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A Short Range Obstacle Detection System using 8051 Microcontroller

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Abstract: Unidentified flying objects (UFOs) and other threats have recently approached and then vanished from our environment, posing a major threat to human safety. We designed a short-range obstacle detection system based on 8051 microcontroller to assist us in detecting this type of impediment and alerting us before we are wondered. To do this, we use a buzzer and an LED in our system, and we're aiming to develop a small system (SROD) to detect the object for detecting the object we used ultrasonic sensor as a radar so when the obstacle is detected by radar the distance is displayed on the LCD.

Keywords: Radar, Ultrasonic Sensor, Keil, SROD, Threat

I. INTRODUCTION

In the past, we used antiquated methods such as cotton tape, scales, and other instruments to measure the distance to an obstacle, but with the introduction of ultrasonic sensors, we were able to improve our technique and obtain faster results, though the obstacle detection system was very useful at the time.[1]

Sir Heinrich Hertz discovered that electromagnetic waves reflect off of many surfaces in 1886. In 1935, a British scientist named Sir Watson Watt invented a module called Radio Detection And Ranging based on such premise (RADAR).[2] Radar is an electromagnetic technology that uses a transmitter to send radio waves to identify objects in its path. Once the object is detected, the radio waves are received.

Nowadays, various types of obstacles are detected; for example, the US Navy recently detected 12-13 unidentified objects with the help of a radar system and used it to protect themselves from the obstacles; also, Israel uses the iron dome system for defense, which is based on a radar system[3] and all of these systems are based on the ultrasonic sensor detection technique so we built an obstacle detection system that detected objects up to 2 metres away and displayed the range on an LCD. We used LEDs and a buzzer for indication so that we could correctly identify them and take appropriate action.

The core principle behind this system is based on the rotation of servo motor for covering the whole range and ultrasonic sensor works and provides us with the necessary information.[4] This system will be used to identify and track aircraft, ground targets and ships at sea, as well as insects and birds in the sky, also monitor vehicle speed and measure atmospheric and oceanic properties.

II. BLOCK DIAGRAM

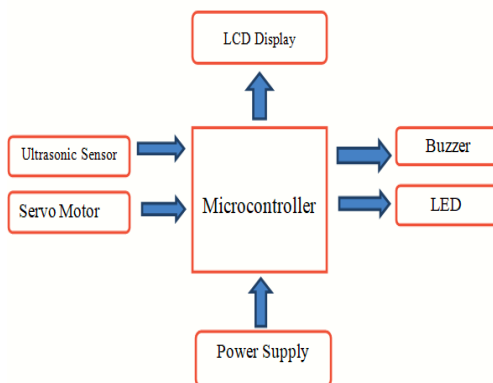


Fig.1 Block Diagram of SROD System

The 8051 microcontroller, servo motor, ultrasonic sensor, led, LCD, and buzzer are all part of this system.

- 1) A microcontroller is utilized to operate the entire system and control the commands for transmitting and receiving signals.
- 2) An ultrasonic sensor detects the obstacle and sends the information to the microcontroller.
- 3) We used a servo motor to monitor the 180- degree area.
- 4) If an impediment is detected, a led and abuzzer are used to notify the user.
- 5) The obstacle's exact location was displayed on an LCD.

III. IMPLEMENTION DETAILS

Very first we create Short Range Obstacle Detection system (SROD) on proteus software by connecting the ultrasonic sensors (HC-SR04),servo motor , buzzer , led to the microcontroller.

The system was then operated via software, which is known as simulation. We connect all ofthe essential connections in simulation to see if our system is running properly or not, and we get the outcome. After that, we add the HEX file of programming code generated by Keil software.

Then system was activated, and the ultrasonic sensor was prepared to detect the obstacle by emitting a transmission pulse and receiving aresponse when the object was detected.

If an obstacle is identified at that point, the ultrasonic sensor's answer is sent to the microcontroller, and the obstacle range is displayed on the screen.[5] If the obstacle is between 100 cm and 500 cm, the green led will illuminate and we will receive information aboutthe obstruction. If the obstruction is less than 100 cm. Then the red led will illuminate and the buzzer will sound and the result will be displayed on the LCD.

A. To Measure Distance

- 1) Object Distance (in cm) = (Sound Velocity* Time) / 2, Where, Sound Velocity = 34300 (in cm per second)
- 2) Here, oscillator frequency of AT89C51 (8051)is 11.0592 MHz, then timer frequency of 8051 will be 921.6 kHz.
- 3) So, Time required to execute 1 instruction is 1.085 us.
- 4) So, timer gets incremented after 1.085 us timeelapse.
- 5) Hence, Distance

$$= [34300 * \text{Timer Count} * 1.085 * 10^{-6}] / 2$$

$$= (\text{Timer Count}) / 54$$

IV. SIMULATION DIAGRAM

Here is The Simulation Diagram Of Our Project.Where all the components are connected with the At89c51 microcontroller and the distance will displayed at the Lcd.

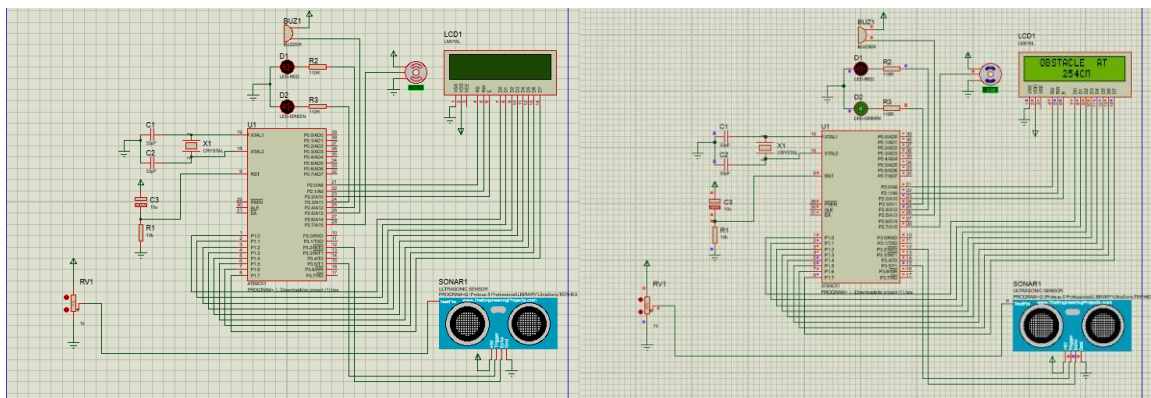


Fig.2 simulation diagram

V. SIMULATION RESULT

On the Lcd Display, we notice the range of obstacles when we start our System. When an obstacle is detected within a 100cm range, the red led illuminates and the buzzer beeps, alerting us that the obstacle is approaching us. The outcome is depicted in the diagram below

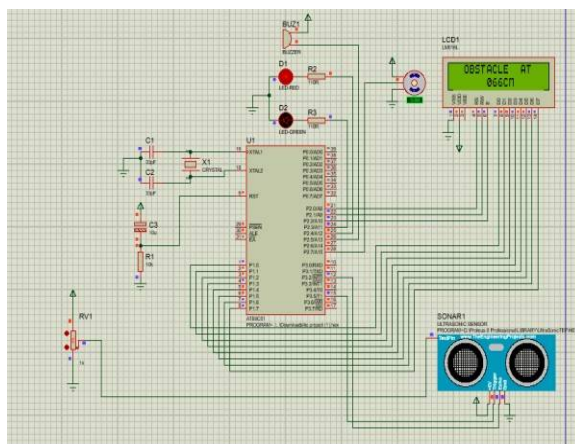


Fig.3 simulation result A

If the obstacle's range is greater than 100 cm, the Green Led will illuminate, and the distance will be displayed on the LCD screen, giving us the precise location of the obstruction.



Fig.4 simulation result B

VI. ADVANTAGES

- A. It has the ability to detect all types of materials.
- B. This sensor is unaffected by dust, rain, or snow in the atmosphere.
- C. When it comes to measuring thickness and distance to a parallel surface, they are more accurate than many other approaches.
- D. Ultrasonic sensors are simple to operate and pose no hazard to neighboring items, persons, or equipment while in use.
- E. The ultrasonic sensor can easily detect exterior or deep objects due to its high frequency, sensitivity, and penetrating strength.
- F. Because it uses an ultrasonic sensor, this range finder is more accurate than earlier approaches.

VII. APPLICATIONS

- A. Radar is a critical military technology since it is used to detect aeroplanes, vehicles, and missiles.
- B. With a high-power ultrasonic transmitter, it can be utilized as a parking aid system in vehicles.
- C. With the appropriate supplementary software, it may be used as a burglar alarm for both houses and offices.
- D. Police officers utilize RADAR speed meters to enforce speed limits.

VIII. CONCLUSION

In this project, Keil software was used to successfully interface an Ultrasonic module HC-SR04 with an 8051 Microcontroller, and the object distance was measured up to 4 metres using the ultrasonic sensor's mechanism; however, this system (HC SR04 ultrasonic sensor) was not capable of measuring longer distances. As a result, we can replace the sensor module to increase the range. This technology will be used to identify objects up to 4 meters away with a 1 cm tolerance, as mentioned in this study. Other devices can readily use the technology as well. The distance of an object or a barrier must be measured from a stationary or moving observation point in either system.

IX. FUTURE SCOPE

- A. A GSM module can be added to send SMS to the person who needs to know about the detected obstacle range for precocious and how to proceed.
- B. A camera can also be used in the system so that we can see a live update on the screen to see what kind of obstacles are present.
- C. Instead of providing a separate voltage source for ultrasonic operation, we used power from the microcontroller to power the sensor and servo motor. The cost of voltage supplies was reduced as a result of this.

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