

REVERSE MOVING CONTROL SYSTEM BY USING BLUETOOTH MODULE

Sandar Oo¹, Myo Yu Yu Thin², Me Me Aung³, Zaw Zaw Aung⁴

Abstract

The “Reverse Moving Control System” is mainly implemented by using Arduino UNO microcontroller board and ultrasonic sensor (HC-SR04). The peripheral components are liquid crystal display (LCD), light emitting diodes (LEDs), piezo buzzer and Bluetooth wireless module (HC-06). The ultrasonic sensor transmits and receives the signals from the obstacles near the automobile. The signal is then sent to the UNO board which is the main controller of the whole system. The distance between the automobile and the obstacle is calculated by Arduino IDE software. The output data is sent to piezo buzzer, LCD and LEDs. Bluetooth module is used to control the moving of automobile in back and forth direction. It is a connection module between automobile and android mobile phone. This device intends to protect the automobiles from accidents during parking. It can also be modified as a backup camera in modern cars.

Keywords: Ultrasonic sensor, Bluetooth module, Arduino UNO, LCD, buzzer, LEDs

Introduction

Nowadays, the population in every country is kept on increasing. The higher the population, the higher the demand of food and shelter we need. To improve the standard of living, new modern constructions are built in downtown area. So, the car owners need to face some problems such as lack of parking space, road condition, traffic congestion, traffic management by police and so on. Among them, the lack of parking space or small parking area is one of the problems to solve. Cities usually mandate that all new residential and commercial buildings have a certain amount of parking. Thus, the parking alarm system is necessary to prevent the automobile from the dangerous conditions.

The main purpose of this research is to design a parking alarm of automobile while parking on crowded and narrow streets. Without a parking sensor, collisions and accidents can happen because the driver cannot see well

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the back or corner of the car. This device can allow the driver to park safely in every small space without having to worry about the circumstances. The system is designed in order to alert the driver of various parked cars and other obstacles. If the parking sensor installed in front and at the rear of the car, it is like having X-ray vision where it is needed, especially when the cars are being parked in a limited space between two cars. This system can fully detect moving or unmoving objects near the car and it gives off alerting beeps to warn the driver to apply the brake. It also has a good safety measure against hitting objects when reversing out of the garage. Nobody is needed to watch out for the car while it is in and out of the parking area.

Arduino is an open-source project that created microcontroller based kits for building digital devices and interactive objects that can sense and control physical devices. The projects are based on designs, produced by several electric components, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards termed shield and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) for loading programs for personal computers.

An ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. Ultrasonic sensor also known as transceivers when they both send and receive work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.

In this way, the car parking circuit is quite easy and used commonly available components such as Arduino Uno microcontroller, ultrasonic sensor (HC-SR04), liquid crystal display (LCD), light emitting diode (LEDs), piezo buzzer and other electrical components. This research is going to develop a Bluetooth controlled robot car. A Bluetooth module (HC-06) is used to drive the automobile by using an android based application. So, the user can control the automobile from a distance without touching the automobile. The block diagram of the constructed system is shown in Figure 1.

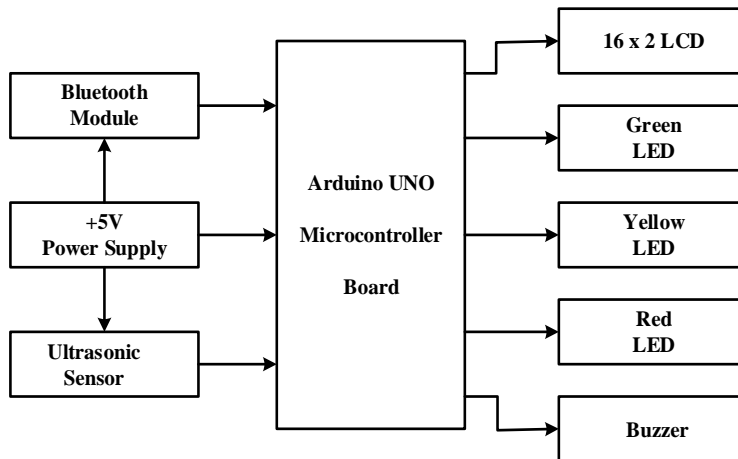


Figure 1: Block Diagram of the Constructed System

Theoretical Background

Arduino Uno Microcontroller Board

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board as a microcontroller and a piece of software, or IDE (Integrated Development Environment) that runs on the computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware which is called a programmer in order to load new code into the board by using a USB cable simply. Additionally, the Arduino IDE uses a simplified version of C and C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the microcontroller into a more accessible package [Yahya Tawil, 2016]. Figure 2 shows the Arduino UNO SMD R3 Microcontroller Board.



Figure 2: Arduino UNO SMD R3 Microcontroller Board

Ultrasonic Sensor (HC-SR04)

HC-SR04 ultrasonic sensor is commonly used with both microcontroller and microprocessor platforms like Arduino, PIC, Raspberry Pie etc. HC-SR04 ultrasonic sensor consists of a transmitter, a receiver and a control module. It is a sensor that works on principle similar to radar or sonar. Therefore, ultrasonic sensor can be used to measure distance. It generates high frequency sound and calculates the time interval between the sending of signal and the receiving of echo. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. Figure 3 shows working principle of Ultrasonic Sensor and frequency (directivity) and influence of the ground is shown in Figure 4 [Marian, P.2013].

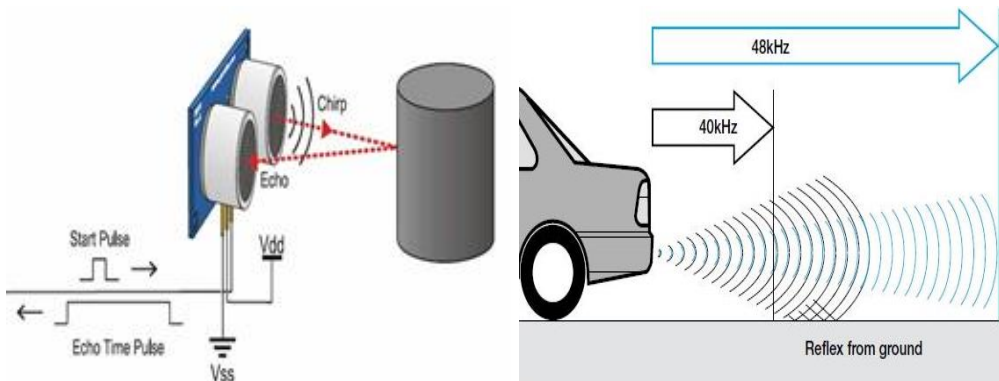


Figure 3: Working Principle of Ultrasonic Sensor

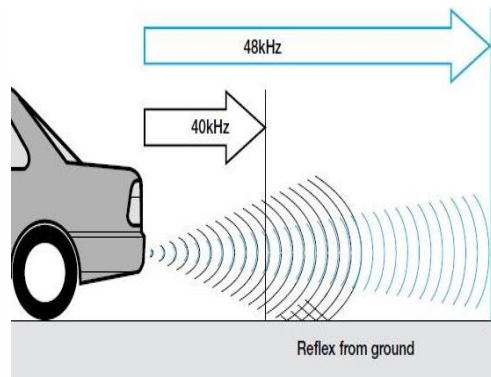


Figure4: Frequency and influence of the Ground

Bluetooth Wireless Module (HC-06)

The HC-06 is a class two slave Bluetooth module designed for transparent wireless serial communication. Once it is paired to a master Bluetooth device such as PC, smart phones and tablets, its operation becomes transparent to the user. All data received through the serial input is immediately transmitted over the air. When the module receives wireless data, it is sent through the serial interface exactly as it is received. No user code specific to the Bluetooth module is needed at all in the user microcontroller program. It uses the UART protocol to make it easy to send and receive data wirelessly. This Bluetooth module has 4 pins: RX, TX, GND and +5V [Stan, 2014].

Construction and Operation of the Whole System

The “Reverse Moving Control System” is mainly developed into three parts:

- (i) Interfacing the peripheral components
- (ii) Circuit description
- (iii) Circuit operation

The circuit construction of the whole system is drawn by Visio software and shown in Figure 4. The detail facts are described in the following sections. Figure 5 shows the flow diagram of the whole system.

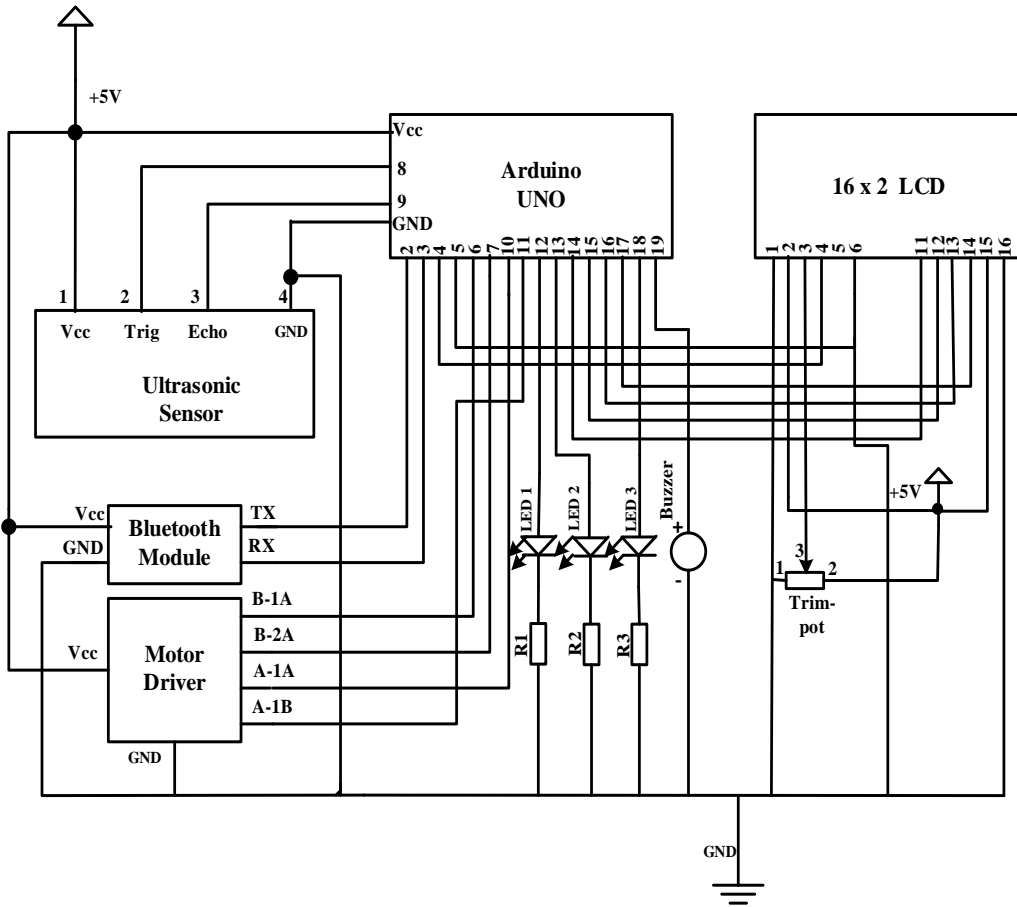


Figure 4: Complete circuit diagram of the whole System

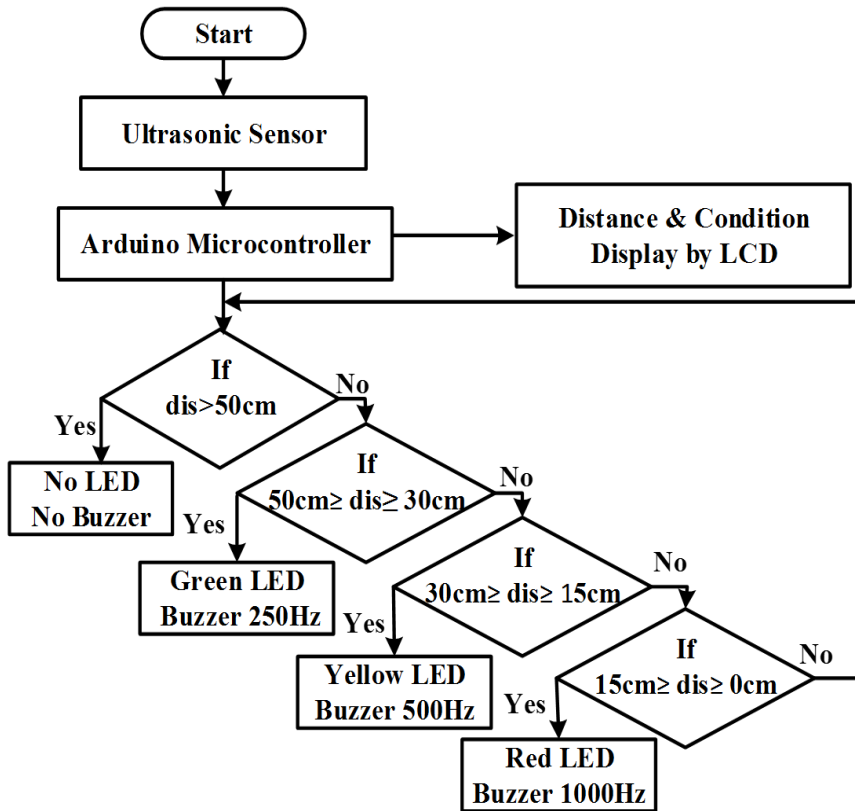


Figure 5: Flow diagram of the whole System

Interfacing the Peripheral Components

Bluetooth-controlled automobile moves according to button touched in the android Bluetooth mobile application. To run this system, Bluetooth RC controller application is installed into the android mobile phone. Then, select desired Bluetooth device and configure keys. Any Bluetooth controller application that supports or sends data can be used. The user gives the command to Bluetooth module through the mobile phone. The Bluetooth module receives this command and transmits to Arduino UNO.

Then, Arduino receives the signal and sends command to the input of the motor driver. The output of the driver is connected to the motor wheels. This automobile has two DC motors at its front sides and two ordinary wheels at its rear sides. Only the front side motors are used for driving the car in

forward and backward direction. When the user touches forward button in Bluetooth controller application, the automobile starts moving in forward direction and moving continues forward until next command comes. When the user touches backward button in Bluetooth controller application, the automobile starts moving in reverse direction and moving continues reverse until next command comes. The motor driver is connected to Arduino to run the automobile.

Circuit Description

In this research, the program is written in Arduino C programming language. It is simulated by using Arduino software (IDE), liquid crystal library and software serial library for Bluetooth module. The Arduino UNO SMD (Surface Mount Device) R3 is a clone Arduino, unlike the other UNO boards; the driver of uploading code CH341SER is needed. Arduino UNO is used compatible with CH340G UART to USB converter. After completing this process, the driver is successfully installed and Arduino UNO R3 is ready to upload the program. Then, connecting Uno microcontroller USB via into computer and choose board and port. Finally, it will compile and upload the program conveniently. After finishing this process, the hardware components are constructed on the circuit board.

LCD display is mainly used to show the distance between the car and the obstacles. The output system also includes LEDs and buzzer. Green, Yellow and red LEDs are used to alert the three different conditions of automobile and the crushing distance. The buzzer is used to give alarm the driver in these three stages.

Circuit Operation

The automobile parking alarm controller system consists of ultrasonic sensor, LCD, piezo buzzer and LEDs. The ultrasonic sensor is placed at the rear side of the car. It emits acoustic pulses with a control unit measuring and returns interval of each reflected signal which is sent to the Arduino UNO board. This board plays as the main control unit of the circuit and calculates the object distances and shows the result on LCD display. It is controlled by a particular program. The sensor also gives the correct idea of the space

available for parking. When the automobile reaches the three limits; 50cm, 30cm and 15cm, green, yellow and red LEDs glow. Different colors of LEDs are used for different types of distance. At the same time, the buzzer produces different sounds when the automobile approaches any object. The sound gets sharper when the distance between the automobile and the target lessens.

Results Discussion

In this research, the circuit construction is very compact and creative. The constructed system is controlled by using android mobile phone instead of using other method like buttons, gesture, etc. The touch button in android phone is needed to drive the automobile in forward-backward direction and stop. The operations are quite simple to test the program in real world. There are four conditions for reverse moving control system:

- (i) Out of range (greater than 50cm)
- (ii) Green LED glowing condition (between 50cm and 30cm)
- (iii) Yellow LED glowing condition (between 30cm and 15cm)
- (iv) Red LED glowing condition (less than 15cm)

Out of Range (greater than 50cm): If the automobile doesn't reach the limited range (50cm), there is no LED light and buzzer sound. Only the correct distance value in centimeter is shown on the first line of LCD and the driver cannot get any alarm. Since the automobile is in safety condition, no message is shown on second line of LCD display. Figure 6 shows the photograph of automobile in out of range condition.

Green LED Glowing Condition: If the automobile keeps on reversing and it reaches the distance between 50cm and 30cm, the green LED glows. The buzzer produces tone with a frequency. The first line of LCD shows the value of distance between the automobile and obstacles. The driver sees the short message "Can Reverse" on the second line of LCD. Figure 7 shows the first condition of automobile with green LED light.

Yellow LED Glowing Condition: When the automobile is at the distance between 30cm and 15cm, the yellow LED glows for the second condition. The buzzer sound gets sharper than the first condition. The LCD shows the current distance and the character words "Little Reverse." Figure 8

shows the second condition of automobile with yellow LED light. At that time, the driver must take care the distance between the automobile and obstacles.

Red LED Glowing Condition: Once the red LED is glowing, the automobile is reaching the distance 15cm and less. The LCD shows a message “Cannot Reverse” to warn the driver. At that time, the driver must apply the brake as there is no more space to reverse. The buzzer produces the sharpest sound to alert the driver. Figure 9 shows the third condition of automobile with red LED light.



Figure 6: “Out of Range” Condition

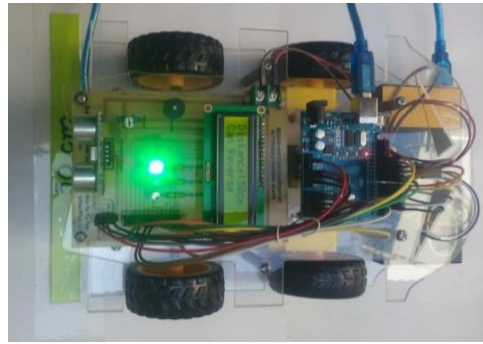


Figure 7: “Can Reverse” condition

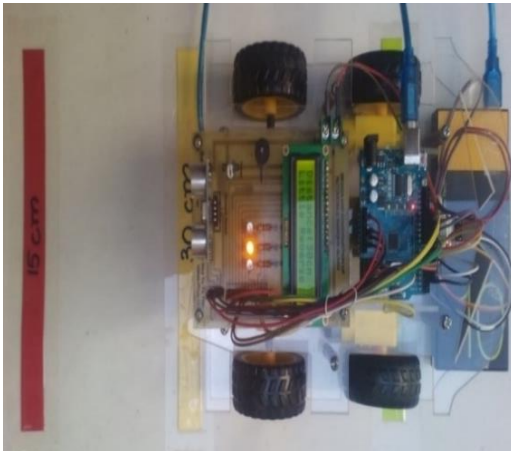


Figure 8: “Little Reverse” condition

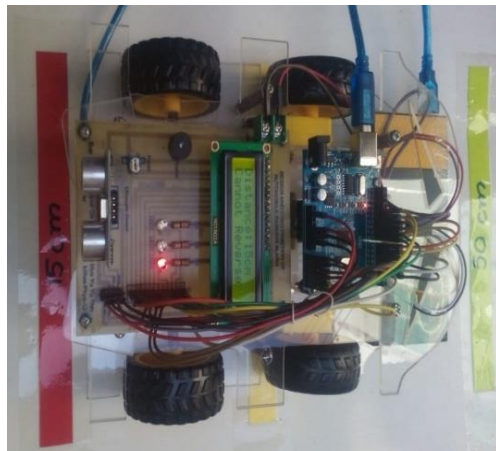


Figure 9: “Cannot Reverse” condition

Conclusion

The “Reverse Moving Control System” is successfully analyzed in real world by a simple design of automobile. This device operates like a backup camera in modern car. The driver can control the automobile very well when using this device. Even a wire fence can be detected if it is close to the automobile. It is not expensive at all. The using of Arduino UNO R3 is cheaper than other UNO board. It is the brain of the whole system. By the use of microcontroller, the system is reliable, accurate and easy to upload the program. The whole system operates automatically and simultaneously. Thus, all the measurements can be taken from time to time. It is a very interesting project for hobbyists and students for fun as well as learning. Nowadays, the modern and luxury automobiles are increasing year by year so such kind of device is necessary to protect the driver and automobile from accident.

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