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Implementation of Automatic Speed Control System for E-Vehicle

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ABSTRACT
In this paper elucidates the functioning of automatic speed control system for Electric vehicle (E-Vehicle) by using Radio Frequency (RF) and embedded system to avoid accidents. From the invention vehicle to till date lots of accidents are happening because of driver's unawareness. This system is helping to alert the drivers and control the speed of the E-vehicle automatically. This system will be more helpful to the existing E-Vehicle structure. Two kinds of scenarios have been considered for the speed control of vehicle. First one is to alert the driver and controlling the speed when crossing the signboard (Slow Speed Sign Board) and another one is to controlling the vehicle speed when any obstacle suddenly comes in front of the vehicle with help of ultrasonic sensor. In addition to the automatic speed control system, driver alert system also implemented successfully. The prototype model of the E-Vehicle tested successfully with these controls by using Arduino Uno Embedded Microcontroller.

Key words: Arduino Uno, E-Vehicle, Radio Frequency, Speed control.

1. INTRODUCTION

The essential intensification of science and technology is aiding to improve our human life in fast manner, especially after the invention of the vehicles. Now a day's big companies are manufacturing Electric vehicles. The more attentions are required in the car driving research area; because of the accident cases are more now a day. In the safety concern, the vehicle security systems are more important especially for the E-Vehicle. It is anticipated that if such a system is premeditated and incorporated into our cars as a road safety device, it will decrease the incidence of accidents on our roads and diverse premises. The Engineers are investing more time to research for the sake of the people safety. When it comes to the use of a motor vehicle, accidents that have happened over the years tell us that something desires to be done about them from an engineering point of view[1].

This implementation system has an expecting to speed control of E-vehicles consequently in urban communities and furthermore in confined territories such schools, parks, clinics and in speed constrained zones and so on. These days in a quick moving world all the people groups are not have poise[2]. Such people groups are driving vehicles in a fast. So the police can't screen each one of those things.

This paper gives a detailed analysis of speed control of E-Vehicle in intelligent way. In the critical zones or critical situation occur then the system will operate automatically and speed can be controlled without intervention of driver. RF transmitter has to be installed in the critical zones and RF receiver installed at the vehicle, which are playing major role to reduce the speed. The controlling system will measure the speed of vehicle by getting the speed meter information[3].

In this paper, section 2 describes the system structural design. In section 3 makes clear the Hardware and software design required for the system. In section 4, discussed about the circuit diagrams and working principle. Section 5 describes prototype model of the implemented system.

2. DESCRIPTION OF SYSTEM ARCHITECTURE

2.1 Transmitter

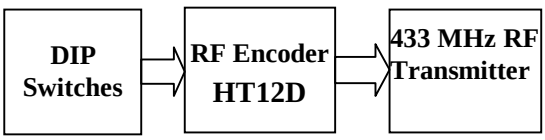


Figure 1: Block Diagram of Transmitter

Figure 1shows the block diagram of Transmitter. In transmitter module RF transmitter with RF encoder (HT12D) is present used for transmitting the information to RF receiver to communicate with the microcontroller[4]-[7]. To indicate the zones DIP switches are used and power supply is provided with 9v HW battery, if any switch is pressed then it is indication for vehicle is in zone and has to maintain the zonal speed, if driver neglects the information then automatic controls are to be taken and vehicle speed reduces with intimation.

Transmitter module is placed at every zone and also at sign boards on highways, hilly areas and over bridges whatever the zone we need to indicate we can place it in that zone this transmitter module is wirelessly connected to the vehicle so both will communicate wirelessly.

2.2 Receiver

Figure 2 shows the detailed block diagram of receiver.

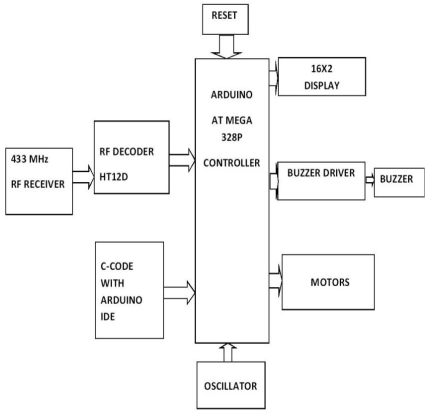


Figure 2: Block diagram of Receiver

2.3 Arduino Pin Diagram

Figure 3 shows the block diagram Arduino Uno.

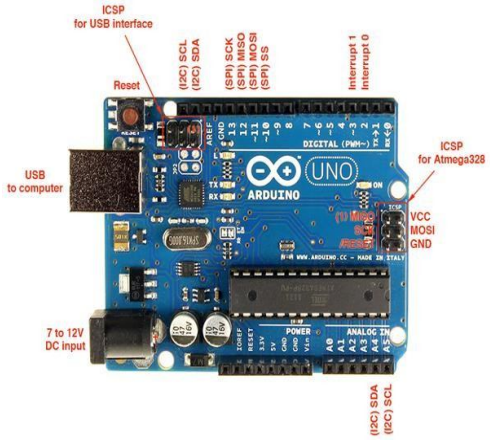


Figure 3: Arduino Uno Top View

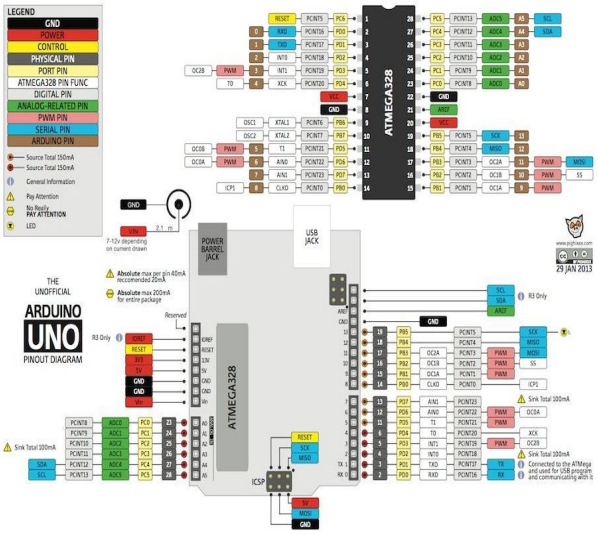


Figure 4: Arduino Uno Pin out Diagram

2.4 Encoder/Decoder

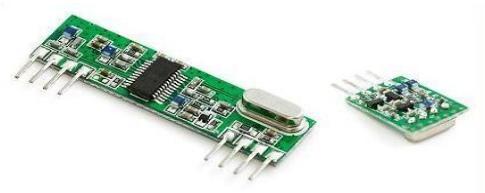


Figure 5: Physical View of RF Transmitter and Receiver

Encoder IC is used to convert the parallel data to serial data and transmit through RF transmitter module. In RF receiver having the encoder which helps to reproduce the original data.

While controlling the E-Vehicle motor, the acceleration and deceleration process has to be happen. But in this above mentioned scenario, whether deceleration process is going to ON or not. So the 2 bits of information are transmitted via RF. 4 channel encoder (HT12E) and decoder (HT12D) ICs are used which are compatible with RF. The schematic is as shown below.

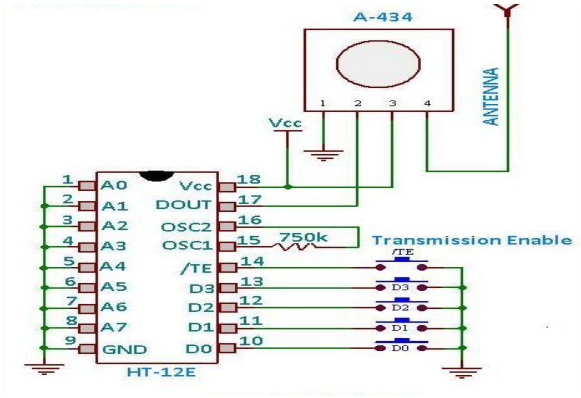


Figure 6: Working of RF Transmitter and Receiver

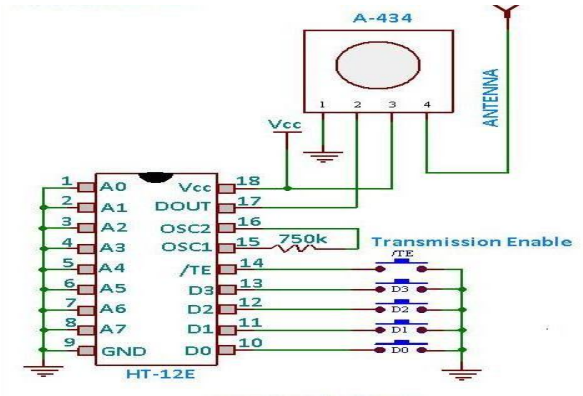


Figure 7: Pin out Diagram of RF Transmitter

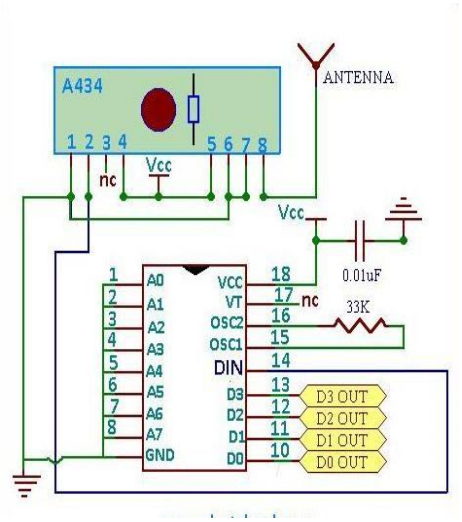


Figure 8: Interfacing of RF Module with Microcontroller

2.5 DC Gear Motor

While selecting the motor for E-vehicle, the load requirements, speed and efficiency are the most important parameters. The gear motor consists of motor with gear box. In this construction, the toque is inversely proportional to the speed. Figure 9 shows the selected DC gear motor for an implementation. Most of our DC motors can be complimented with one of our unique gear heads, providing you with a highly efficient gear motor solution.

Figure 9: DC Gear Motor

2.6 Ultrasonic Sensor (HC - SR04)

The Ultrasonic sensor is a sensor which is having the capability of transmitting and receiving. Ultrasonic waves are employing in ultrasonic sensor. Figure 10 shows the Ultrasonic sensor.

Figure 10: Ultrasonic Sensor

2.7 LCD Display

LCD display is used to display the present speed of the vehicle and critical zones. It is 16x2 LCD display. The rating of the LCD display is (3-9) V and 1 mA. Figure 11shows the LCD display circuit diagram.

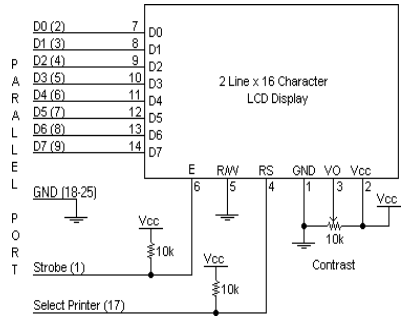


Figure 11: Pin Description

3. HARDWARE AND SOFTWARE DESIGN

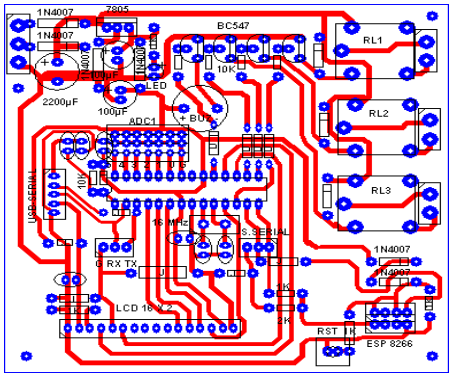


Figure 12: PCB Design and Layout

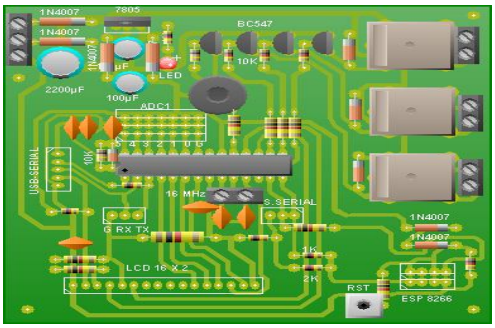


Figure 13: Assembling on Arduino on PCB

3.1 Flow Chart

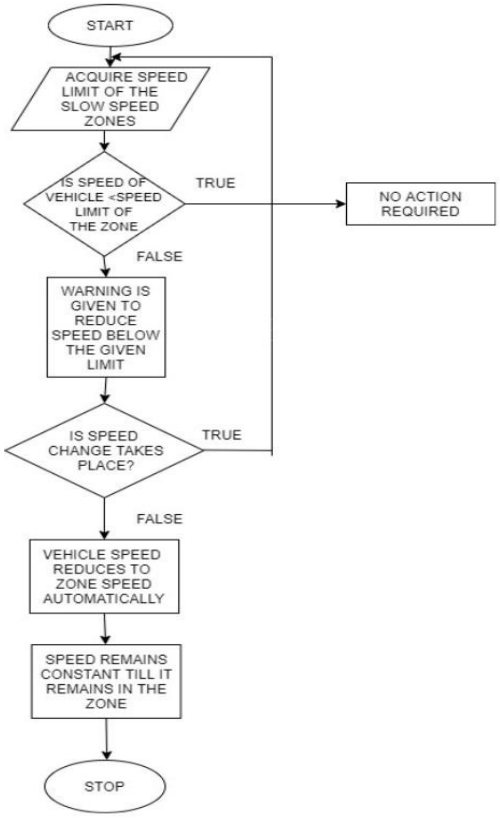
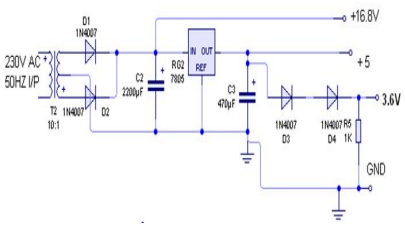


Figure 14: Flowchart

In figure 14 shows the flowchart of the automatic e-vehicle control system in slow speed zones, the process flow of the prototype is shown in the flowchart where automatic speed control of vehicle takes place in zones.

4. CIRCUIT DIAGRAM AND WORKING

4.1 Circuit Diagram



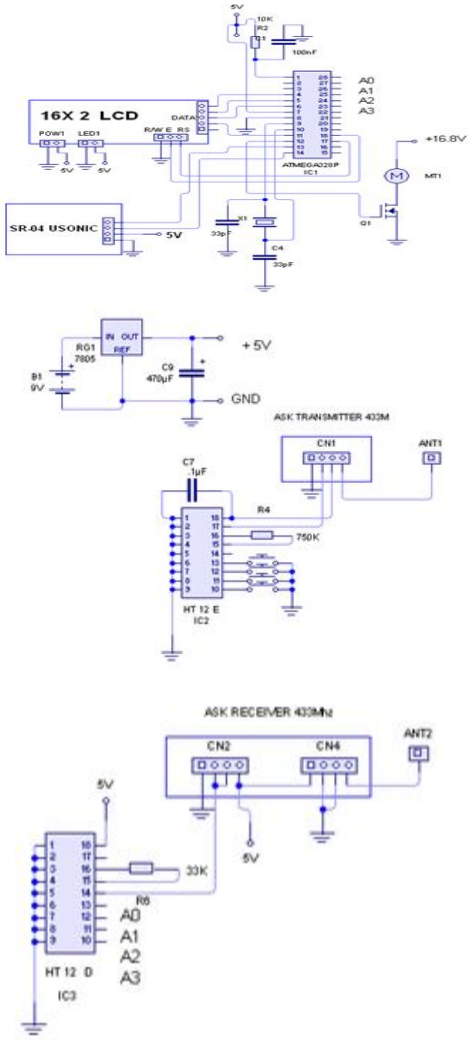


Figure 15: Circuit diagram

4.2 Working

When the vehicle enters the critical zones like schools and hospitals with more than the allowed speed, the system will start functioning by identifying the speed and the zones with RF technique. Then immediately buzzer will alarm, if driver not responds and the speed of the E-Vehicle will be reduced by the system. By this condition driver cannot accelerate the vehicle. When entering other zones, the driver having the control, he can accelerate or decelerate the vehicle according to his view. Speed meter will display the actual speed of the vehicle. System will measure the actual speed with allowed speed frequently. This will be elaborately given with two cases.

One case is the speed of vehicle is less than the speed limit of road at that point no activity required then vehicle can go regularly.

If speed of vehicle is greater than the speed limit of the slow speed zone and speed of that zone to be maintained is displayed on LCD Display to maintain that particular speed also the message is given to the driver to control the speed

below the allowed speed. If speed change is occur within minimum time period then it is ok. But, if driver does not reduce the speed below speed limit of that zone then microcontroller gives command to the motor by reducing its voltage then speed of motor also reduces and maintains the zonal speed until it passes over the particular zone. Whenever obstacle enters in front of the vehicle then vehicle slows down automatically and also stops immediately if distance between less, so that we can also prevent vehicle from accidents by maintain distance between vehicles, we can also implement anti- collision principle to this vehicle so that speed decreases automatically for maintaining specific distance in between the vehicles then accidents occurring rate will become quite low.

5. HARDWARE DESCRIPTION

5.1 Hardware Kit

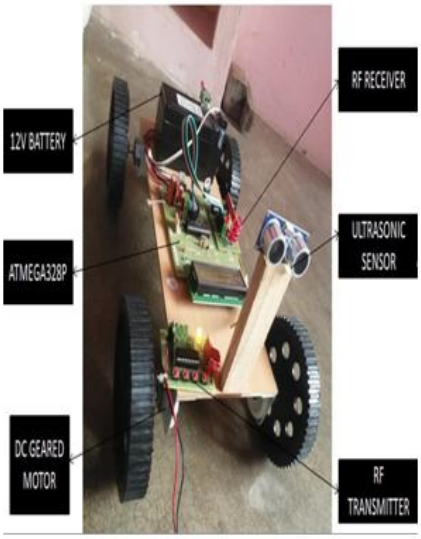


Figure 16: Hardware Kit

5.2 Results

When power supply is supplied to kit initially battery gets charged, this charged battery is used for entire kit. As soon as the kit is turned on "speed control at sensitive zones" is displayed on LCD as shown in Figure 17.

Figure 17: Vehicle LCD display

When we are about to enter in into school zones first of all an indication will be shown to maintain 20KMph speed, if driver neglects whatever is being said in indication then vehicle is automatically slowed down to the speed limit and maintains constant speed throughout that zone this indication will be shown in LCD as shown in Figure 18.

Figure 18: Indicating school zone

When we are about to enter into over bridge first of all an indication will be shown to maintain 40KMph speed, if driver neglects whatever is being said in indication then vehicle is automatically slowed down to the speed limit and maintains constant speed throughout that zone. This indication will be shown in LCD as shown in Figure 19.

Figure 19: Indicating over bridge

When we are about to enter into hair pin bend (hilly areas), first of all an indication will be shown to maintain 30KMph speed, if driver neglects whatever is being said in indication then vehicle is automatically slowed down to the speed limit and maintains constant speed throughout that zone as shown in Figure 20.

Figure 20: Indicating hair pin bend

When we are about to enter into danger zone first of all an indication will be shown to stop the vehicle, if driver neglects whatever is being said in indication then vehicle is automatically stopped. This indication will be shown in LCD as shown in Figure 21.

Figure 21: Indicating danger zone

During a drive if an obstacle suddenly interferes or suddenly comes in front of a vehicle stops by giving alarm to avoid accident. This indication is shown in LCD as shown in Figure 22.

Figure 22: Showing the Distance of Obstacle

5.3 Advantages

- The cost of the vehicle is very less compared to its application.
- It helps to reduce most of accidents occurs in schools and hospital zones.
- It also helpful for the people to drive safely without their knowledge.
- Because of using microcontroller the cost of this development is low to implement it in a vehicle.
- This system helps to avoid the rash driving of the vehicles.

6. CONCLUSION

This project is an incredible lifesaving framework in overwhelming rush hour gridlock and speed limit territories. In this way, the AUTOMATIC E-VEHICLE CONTROL SYSTEM IN SLOW SPEED ZONES is structured so that to limit the speed of vehicle in slow speed regions. The accidents are normally happens not only the irregular E-vehicle drivers, but the opposite vehicle also the reason. In this, project successfully implemented to identifying the opposite vehicle with short duration and corresponding actions have taken. The beautification of this project work is directly helping to the public people to who walks on the restricted zones.

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