

Autonomous Cruise Control and Accident Prevention of Vehicles using Arduino

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Abstract: Day by day accidents are increasing. Most of the road accidents occur due to the drivers drive vehicles at high speed even in speed limited area such as traffic signals, school zones, hilly regions, highly curved paths without considering the traffic rules. The traffic police are not able to control them with full effect and thus lead to major accidents at traffic signals. This work mainly aims at automatically controlling the speed of vehicles at speed restricted place like traffic signal and the prevention of accident is done by ultrasonic sensor. It is used to get information from other vehicles. The controller units calculate the distance and makes the decision on processed data.

Index Terms: speed control, accident prevention, motor driver, autonomous cruise control

I. INTRODUCTION

Nowadays, the increase of the transportations like car, bus and two wheelers in major cities of world raise a need to avoid accident in our society. The increasing number of vehicles has increases the accident rate. To control and monitor the speed of vehicles on traffic signals the respective departments of government has taken necessary step[1-7]. But it's not doing enough. So that automation of speed control at traffic signal is introduced. It is also called as traffic-aware cruise control or dynamic radar cruise control. It is an advanced cruise control system that adjusts the vehicle speed automatically for preventing the vehicle from accident and also maintains a safe driving. This can be controlled by using sensor based information from on-board sensors such as RF module and ultrasonic sensor that allowing the vehicle to slow down or stop when it detects the car is approaching another vehicle ahead, then accelerate when traffic allows it to proceed, also use vibration sensor to detect accidents.

II. METHODOLOGY

The ultimate goal of this work is to reduce the speed of the vehicle while violating the traffic signal rules and also prevent accidents by using of ultrasonic sensor. This work having three blocks, first block is at traffic section second one is at vehicle 1 unit and the last one is at vehicle 2 unit. For real time application the traffic section is fitted in every traffic signal and other two sections are fixed in all vehicles. The Arduino Uno is used extensively across all blocks.

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Arduino-Arduino is an open-source microcontroller-based kits for building devices which can be extensively used in digital world and interactive things to sense and control physical devices. Arduino is based on microcontroller board designsto implement various functions. It consists of digital and analog input/output(I/O) pins that can interfacing various external boards and other circuits. This provides an additional feature such as Universal Serial Bus (USB) for loading programs from computer systems. The Arduino provides an integrated development environment (IDE) based on a programming languages such as C and C++.

A. TRAFFIC SECTION:

In traffic section unit, ArduinoMicrocontroller (ATmega328) is used. This will control the overall functional unit.

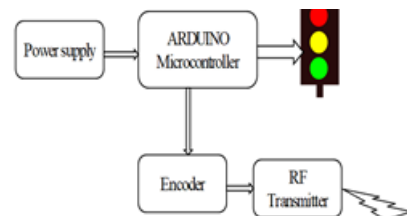


Figure:Traffic section

The Arduinomicrocontroller gives the informational input to the traffic signal. Based on the given input the traffic signal color and time delay for the signal will be determined. The encoder is used in the traffic section because to avoid any frequency mismatches during processing (we use RF transmitter and receiver whose frequency is 433.3 MHz). Due to possibility of interference from other similar frequency communication, the use of encoder is essential. Then RF transmitter sends all the data (time delay, traffic signal ID etc.,) to the vehicles.

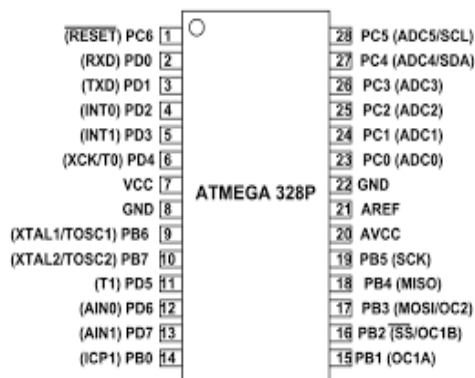


Figure: Pin Diagram

Arduino Uno may be a microcontroller board supported the ATmega328P. It has 14 digital pins, 6 analog input pins, a quartz crystal having 16MHz frequency, a USB interfacing facility, an In Circuit Serial Programming header and a reset button. It supporting the microcontroller to simply connect it to a computer system with a USB cable or AC-to-DC adapter. Arduino Uno has the large number of facilities to interfacing with a computer systems, another microcontrollers, or other Arduino boards.

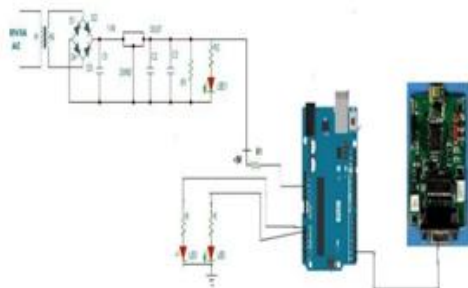


Figure: Traffic Section circuit diagram

B. VEHICLE 1 UNIT:

In this work there are two vehicle blocks are used. The first vehicle block diagram is shown below.

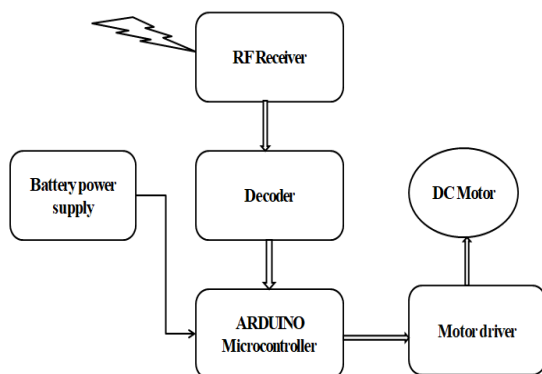


Figure: Vehicle 1 unit

The signal which sent by the RF Transmitter at the traffic section is received by the RF Receiver which can be fitted in the vehicle. The received information is decoded by the decoder used in our circuit. The transmitter and receiver used in this work is RF (HT12E and HT12D). The color (Red or Green) the signal and time delay for that signal and all other information are send to the Arduino Microcontroller. Based on the information obtain from the receiver module the microcontroller regulates the motor speed through motor driver.

Motor Driver- The motor driver is a little current amplifier. The function of motor driver is totake the low current control signal and then turn it into high current signal that can drive a motor. Motor drivers are circuits used to run a motor. They are commonly used for motor interfacing purpose. The motor driver circuit is easily interfaced with the motor.L293D micro controller is used in the motor driver which is shown below.

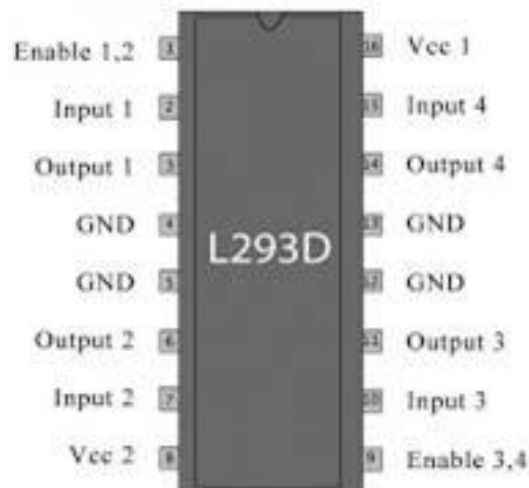
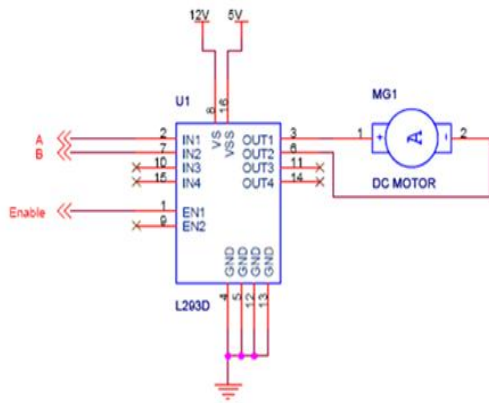


Figure: L293DMicrocontroller pin diagram

Based on the pins the circuit connection and the truth table description of the L293D microcontroller are shown below.



Truth Table

A	B	Description
0	0	Motor stops or Breaks
0	1	Motor Runs Anti-Clockwise
1	0	Motor Runs Clockwise
1	1	Motor Stops or Breaks

Figure:L293 circuit connection and truth table

RF Module-The RF transmitter and receiver are the smaller electronic devices used to transmit and receive radio signals between them. They are desirable to communicate with another device wirelessly. This wireless communication is done through Radio Frequency communication. An RF Transmitter module (HT12E) is capable of transmitting the radio wave and modulating that wave to carry data. Transmitters typically regulate the utmost allowable transmitted power output, harmonics etc., Associate in Nursing RF Receiver module (HT12D) receives the modulated RF signal from the transmitter fitted within traffic section and also demodulates the transmitted signal. There are two types of RF receiver modules. They are super heterodyne receiver and super regenerative receiver. Super heterodyne receiver has a performance advantage over super regenerative, they offer increased accuracy and stability over a large voltage and temperature range.

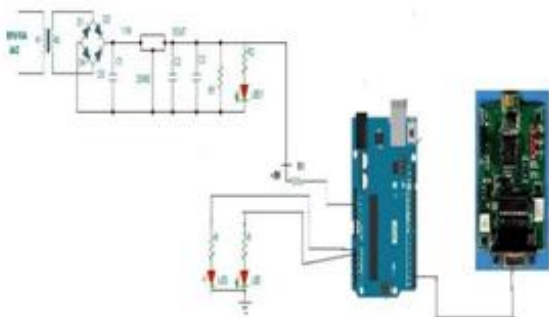


Figure: Vehicle 1 Unit circuit diagram

C.VEHICLE 2 UNIT:

We explained two concepts in this work. One is to reduce the speed of the vehicle while violating the traffic signal rules

(automatically the vehicle will slow down for red signal and comes into vehicle motor normal position for green signal) and another one is accident prevention (autonomous cruise control of vehicle) of vehicle by using ultrasonic sensor. The first concept is done by vehicle 1. In vehicle 2 unit the accident prevention concept is applied. The vehicle 2-unit block shown below.

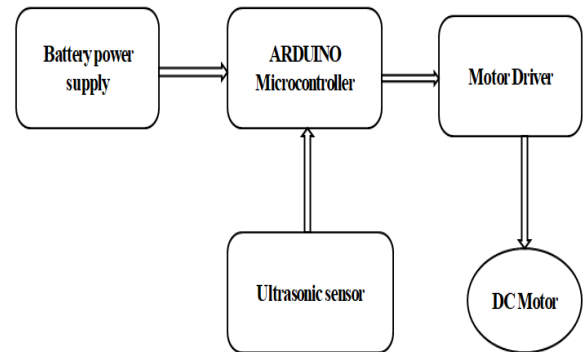


Figure: vehicle 2 unit

Ultrasonic sensor -The ultrasonic sensor which is fixed in the vehicle that can measure the distance between the vehicles by using ultrasonic waves. The sensor heads emit 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 the reception. Ultrasound is a very high frequency acoustic wave, which is beyond the normal audible range of humans. Since the audible frequency range is said to be between 20HZ to 20KHZ. It generally means acoustic waves above 20KHZ. Based on this information, vehicle can either stops or overtakes the other vehicle according to the current situation.



Figure: Sensor Working

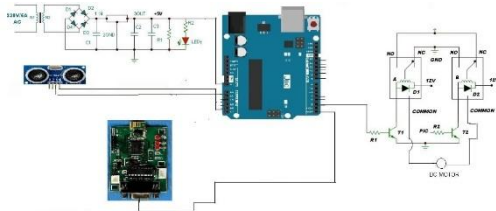


Figure: Vehicle 2 Unit circuit diagram

FUTURE SCOPE:

Transportation systems square measure an essential part of human activities. Survey report shows that an 40% of the total population spends minimum one hour on the road every day. Now a days people mostly dependent on transportation systems in current days, transportation systems not only face several opportunities it also face several challenges as. The country's competitiveness, its economic development and its productivity are heavily depends on the transportation performance of the country. Intelligent Transportation Systems (ITS) have attracted increasing attention in recent years due to their great potential in meeting this above-mentioned transportation challenges. Advanced Vehicle Control System (AVCS) is a part of an ITS. The central theme of AVCS is to improve the throughput and safety of highway traffic by using automatic control with its precision and fast reaction to replace human drivers

II. CONCLUSION

In modern developing world, the increase of transportation needs to reduce accidents and thus a method to avoid vehicle collision has been achieved. Thus the speed of the vehicles in the speed limiting zones such as traffic signals and the accident prevention using ultrasonic sensor can be achieved through this work.

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