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Research Paper

GPS enabled embedded veichle speed limiting device for electric veichles

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Abstract

Many of the accidents are caused due to the over speed of the vehicles. The vehicle user's drive above the speed limit in speed restricted areas. According to the statistics, in India there are more than 1,00,000 fatal crashes per year. With various implantations the numbers of accidents have been decreasing. The speed of the vehicle is prevented by the implementations. One of such implementations is to control the speed by using GPS. The aim of this paper is to design an embedded system that automatically control speed of the vehicle based on its location determines by GPS module. The system will make use of Arduino micro controller connected to the GPS module which is connected to GPS antenna. The GPS antenna is used to determine the latitudes and longitude of the vehicle. The latitude and longitude are displayed on the LCD display. A gear motor is connected to Arduino which receives the information from GPS antenna. The system output will be determined from the Engine Control Unit (E.C.U). Each zone is limited at a certain speed. Whenever the vehicle enters into that zone the speed is controlled by controlling the RPM so that the over speed will be reduced to a desired speed limit.

Keywords: *Arduino; Engine Control Unit; GPS; LCD Display; Speed limiting.*

1. Introduction

The key risk factor of road injuries and accidents is identified as speed which results in the severity of the injuries. Inappropriate speed driving in unsuitable conditions such as vehicle population, road network, human population, length of the road and by adhering the rules and regulation given by road safety authorities. Fatalities, disabilities, injuries, and hospitalization are the causes of road accidents. On the Indian roads speeding the major cause of accidents which leads to maximum deaths [1]. According to the population and roads India is the second largest in the economy. India has less than 3.8 kilometres of roads per 1000 people [6]. Almost all the roads are narrow and single way so frequently accidents occur in each minute. For every 4 minutes one person is dying [4] due to road accident. major cause for road accidents is over speeding and rash driving minute in our country a serious accident is occurring and 16 die on Indian roads every hour [6].

The aim of this project is to provide an simple and effective way to control the speed of vehicle. By controlling the speed of the vehicle at its location the number of fatal accidents will be reduced. A GPS is used to track the location of the vehicle [1]. The system proposed in this paper is cost effective, reliable and has the function of exact speed tracking and controlling the speed of the vehicle. It is totally a combined system so that it can be implemented on all vehicles. The use of GPS technologies allows to track the objects and provides up to date information. The GPS is used to track the latitudes and longitudes form the satellites. The arrangement can be actualized by utilizing GPS innovation [4]. Equipment in this is GPS module, Arduino, LCD show, GPS Antenna, control supply. With GPS (worldwide situating framework) one can naturally decide the exact area anytime on earth utilizing a ground gadget that grabs signals from different satellites [3]. Microcontroller screens GPS module in prefixed interims.

2. System architecture

a) Flow chart

The whole process of the project is described in the flow chart. All the parts are connected to each other in serial order. The LCD display is being initialized first. The latitudes and the longitudes are displayed on the LCD. The GPS modem is being initialized by using a gps tracker. The project is implemented on the nongear vehicles. In nongear vehicles an electric motor is present which has number of rotations per minute. The pin configuration for the LCD, gps modem, motor pin is initialized. The gps antenna is used to trace the latitudes and longitudes. While the gps antenna is tracing the latitudes and longitudes they are displayed on the LCD.

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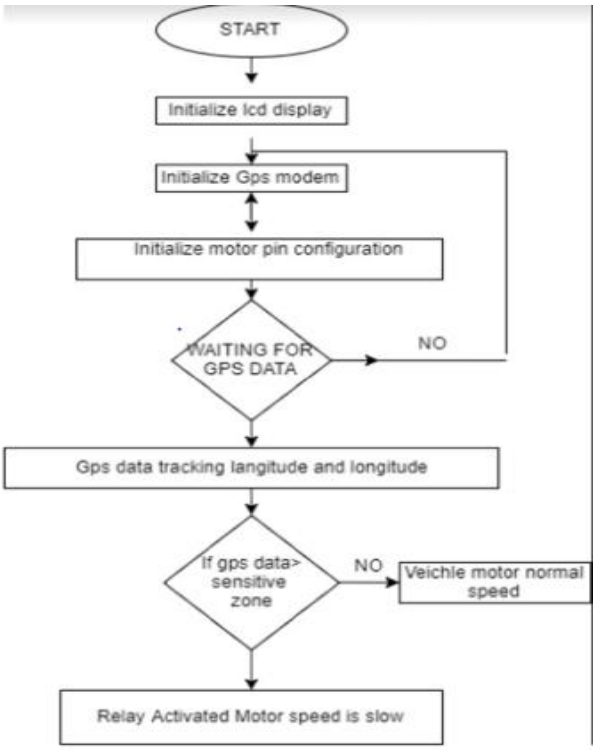


Fig. 1: Flow Chart.

b) Circuit diagram

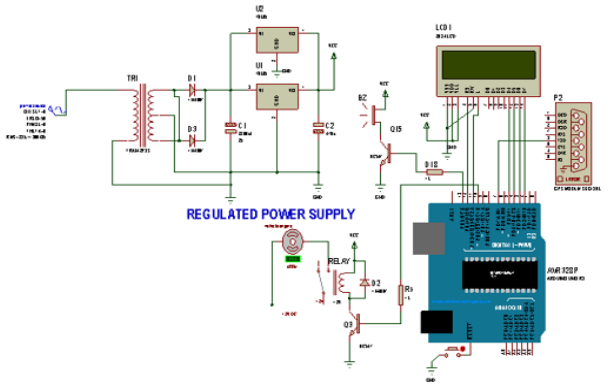


Fig. 2: Circuit Diagram.

The Circuit diagram shows the whole process involved in the project. The LCD is connected to arduino and the gps antenna is connected with the arduino and the power supply is connected to the arduino board. The latitudes and longitudes and traced using the gps antenna and are displayed on the LCD display. The relay motor is internally connected with the power supply and the speed of the vehicle is controlled by controlling the rotations per minutes of the relay. The power supply that is applied to all the components is 12v.

3. System description

a) Arduino UNO

Arduino Uno is a micro controller from the family of ATmega 328. The Arduino Uno consists of 14 digital inputs. They can be used either as input and output. The digital pins perform three functions. They are pinmode(), digitalwrite(), digitalread(). The digital pins operate at 5 volts. Each of the pin can provide or receive 40 mA. It has a pull up resistor of 20-50 kOhms [1]. The Arduino Uno consists of 6 Analog pins. (A0-A5). Each provides 10 bits of resolutions. There are other pins like reset, external oscillators, Vcc, Gnd and a build in LED connected to a digital pin. A reference voltage for analog input is used. The Arduino Uno supports the SPI Communication.

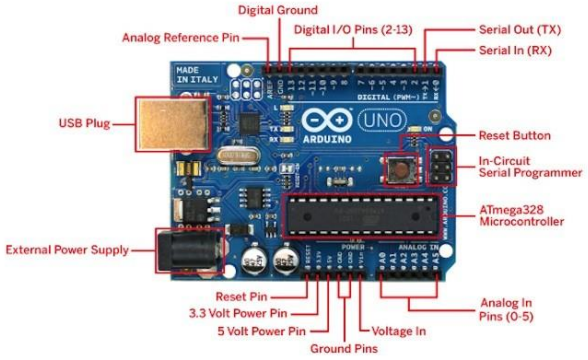


Fig. 3: Arduino UNO Pin Diagram.

Table 1: Specifications of Arduino Uno

Micro controller	ATMega 328
Operating voltage	5v
Input voltage(recommended)	7-12V
Input Voltage(limits)	6-20V
Digital I/O pins	14
Analog Input Pins	6
Clock speed	16MHz
SRAM	2KB
EEPROM	1KB
Flash Memory	32KB
DC Current per I/O pin	40 mA

b) GPS

Global positioning system (GPS) is a device used to track the location of the device. It is a group of satellites that receives signal from GPS transmitter and sends data to GPS receiver. The GPS performs at a baud rate of 4800bps [4] and has 1 µs delay time. Initially, the flag of time is sent from a GPS satellite at a given point. Along these lines, the time contrast between GPS time and the purpose of time clock which GPS collector gets the time flag will be ascertained to produce the separation from the beneficiary to the satellite. A similar procedure will be finished with three other accessible satellites. It is conceivable to ascertain the position of the GPS beneficiary from separate from the GPS recipient [3] to three satellites. Be that as it may, the position created by methods for this technique isn't precise, for there is a blunder in figured separation amongst satellites and a GPS beneficiary, which emerges from a period mistake on the clock joined into a GPS recipient. For a satellite, a nuclear clock is fused to create on-the-spot time data[1], however the time produced by tickers fused into GPS recipients isn't as exact as the time produced by nuclear timekeepers on satellites. Here, the fourth satellite comes to assume its part [4]: the separation from the fourth satellite to the recipient can be utilized to figure the position in relations to the position information produced by remove between three satellites and the collector, thus lessening the room for give and take in position precision.

c) L.C.D

The L.C.D is used to display the output of the system. The latitudes and longitudes are displayed and the speed limit for the current location, and the speed of the vehicle are displayed. The L.C.D is connected to the micro-controller by its pin configuration. There are 3 control pins in L.C.D. they are RS, RW, E. there are 8 data bit lines (DB0-DB1), a ground and a power supply. Each input pin is set to 5V. the L.C.D is interfaced with micro controller. The LCD module used in this project is 16X2 L.C.D display. It has 2 lines with 16 characters per line. The L.C.D display has 8 bits for data transfer using parallel interface.

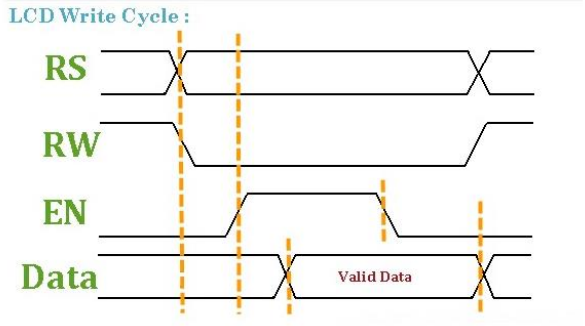


Fig. 5: L.C.D Write Cycle.

d) Power supply and management

RS-232 is used for transmitting the data through serial communication. While interfacing GPS ReceiverRS232 Serial/USB with Arduino a level shifter called max232 is used because Arduino and GPS Receiver RS232 Serial/USB are different logic levels. Reading GPS information through RS232 port requires outside power. When we associate GPS Receiver-RS232/USB through USB requires no outer power. Power is taken from USB port itself.

This microcontroller mostly operates at 5V supply. To convert from 12V battery to 5V specification voltage regulator will be used. This helps in increasing the life time of the battery.

4. System implementation

a) Test location

Here we selected the campus roads of KL University to control the speed of the vehicle [6]. The map shown determines the path of vehicle where the speed limit is already assigned with different speed limits at different locations. Each location is indicated with different colours. The path is selected to test at normal speed, slow speed and at high speed limit. The vehicle in that path is traced by the G.P.S by its latitudes and longitudes [6].



Fig. 4: Test Area Location.

b) Determination of speed zone

After the speed is assigned to each path location, the Arduino microcontroller use the co-ordinates of the location that are obtained from G.P.S [6]. The obtained values of G.P.S and present values in the data base are compared. Then the vehicle enters into the assigned speed limit automatically. Each path location is plotted with different colours for determining different speed limits. The latitudes and longitudes of some different locations at different speeds are shown in the following table.

Table 2: Test Area Location Co-Ordinates

REGION COLOUR	LATITUDE,LONGITUDE	SPEED
Green	1626.6130,N,08037.2180,E,092326.0 1626.6223,N,08037.3084,E,092822.0 1626.6047,N,08037.4196,E,093338.0	50MPH
Blue	1626.5363,N,08037.3576,E,095718.0 1626.5385,N,08037.3932,E,100007.0	5MPH
Maroon	1626.5455,N,08037.3493,E,095106.0 1626.6043,N,08037.3421,E,095352.0	15MPH
Yellow	1626.4360,N,08037.4091,E,093023.0 1626.5271,N,08037.3937,E,094133.0 1626.6033,N,08037.3876,E,093641.0	60MPH
Red	1626.4170,N,08037.3575,E,092331.0 1626.5288,N,08037.3476,E,094514.0	30MPH
Pink	1626.5226,N,08037.2636,E,091527.0 1626.5376,N,08037.3399,E,094901.0	10MPH

c) Hardware execution

Firstly the power supply is given to the system. The power supply required for this system is 3.3V. The general power is 230V. The voltage is converted to required voltage using rectifiers and capacitive filters. The G.P.S antenna gets signals from the satellites and read the latitudes and longitudes of the vehicle at a location. The co-ordinates will be sent to L.C.D display through G.P.S receiver. The co-ordinates will be displayed on L.C.D display. Since the system is implemented on non gear vehicles, a gear motor is connected to G.P.S receiver. Once the latitudes and longitudes are received, the gear motor starts rotating. The speed of the gear motor is controlled by controlling the rpm (rotations per minute). The signal is transmitted using bit by bit data transmission. The latitudes and longitudes are taken at different speed limits. The gear motor works at a speed limit at a particular location either at high speed, low speed or normal speed. The process of displaying values on L.C.D depends on receiving the interrupts from Arduino to L.C.D connection.

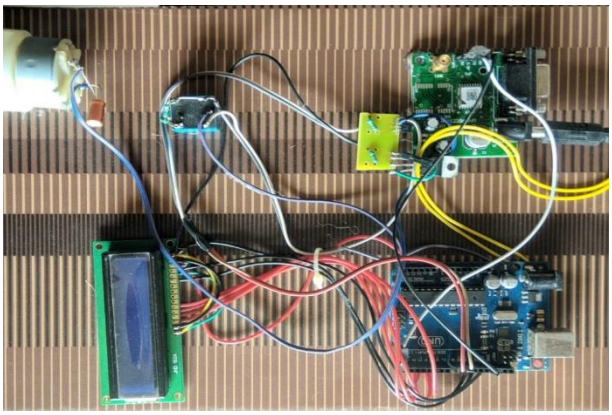


Fig. 6: Hardware Implementation Board.

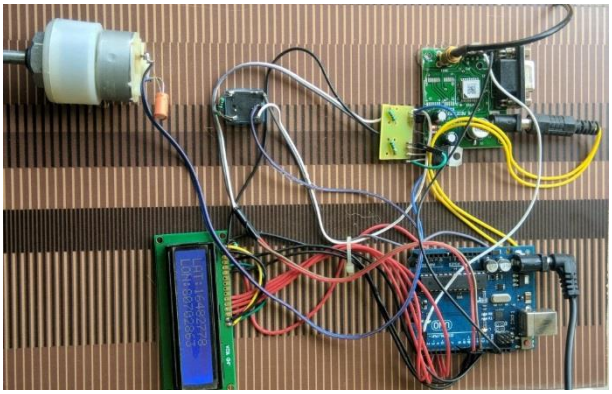


Fig. 7: Latitudes and Longitudes Displaying on L.C.D.

5. Conclusion

By using this system the speed of vehicle is controlled so that we can avoid the fatal accidents happening due to the overspeed. It is a simple way to reduce the speed of the vehicle and is cost effective. This system is now implemented on gear less vehicles. further implementation can be done on autonomous vehicles. To make better implementation GSM module is implemented to send and receive messages. It makes system more effective. Based on the experimental observation, a more sensitive GPS device can be used to make clear difference between the odometer values and existing speed limit. A GSM module, more sensitive GPS, and implementation on autonomous vehicles improves the safety for vehicles on roads.

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