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Electrical Vehicle Speed Limiter using RF Technology

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ABSTRACT

The objective of the project is to provide speed limitation to the electrical vehicle as per the speed sign boards. The system uses the RF (Radio Frequency) communication between speed sign post and the vehicle control system. Whenever a vehicle comes in range of the RF speed sign post, the sign post transmits the speed limit for that particular road to the vehicle system. The vehicle controller system receives this signal through RF receiver and processed through the microcontroller. If the system was at lower speed than the limit received from the sign post, then there will be no changes made to the speed of the system. If the speed of the vehicle was manually incremented to a higher value, then the controller will impose the speed restriction and bring back the speed value to the value specified by the limit. Now if the user tries to increase the speed, the system does not allow it to do so till it is in range of the RF speed sign post. The speed of the vehicle and the limits are displayed on an LCD.

Keywords : RF Module, Arduino, HT12E, HT12D, IR Obstacle Avoidance Sensor, Relays, DC Gear Motor, LCD Display.

I. INTRODUCTION

Now a day the number of accidents on road due to over speeding is increasing. Not only the number of accidents but also the number of fatalities due to this over speeding also increased. In a recent survey it was told that the number of fatalities in INDIA in 2017 is nearly 150,000. The valuable human life is lost due to recklessness and rash driving of vehicles by their drivers. Government is taking so many measures to control the accidents but there is no change in the number of accidents even the number is increasing. As in the near future the present vehicles will be replaced by electrical vehicles, we are designing a system to regulate the speed of the vehicles by using RF technology. This method is simple and economical when compared to other wireless technologies.

The transmitter section will be in the speed sign board and the receiver section will be in the vehicle. The transmitter section will continuously transmit the signal. Whenever the vehicle comes in to the speed regulating zone of the speed sign post, the receiver in the vehicle will receive the signal and then the controller unit will control the speed of the vehicle according to the speed zone limit. If the vehicle speed is more than the zone limit then the controller will act and the speed of the vehicle is regulated to match the zone speed limit. If the vehicle speed is less than the zone speed limit then there will

be no change in the speed. The zone speed limit, vehicle speed and the action message will be displayed on LCD.

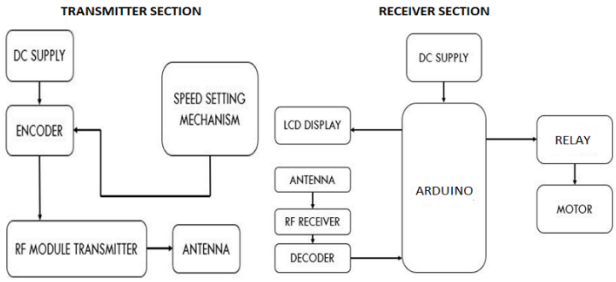

Fig.1: Block Diagram of Electrical Vehicle Speed Limiter Using RF Technology.

II. METHODS AND MATERIAL

We have several parts in this system to explain. We can look at them one by one .Firstly, we take

A. RF MODULE:

An RF module (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication.

For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and a receiver.

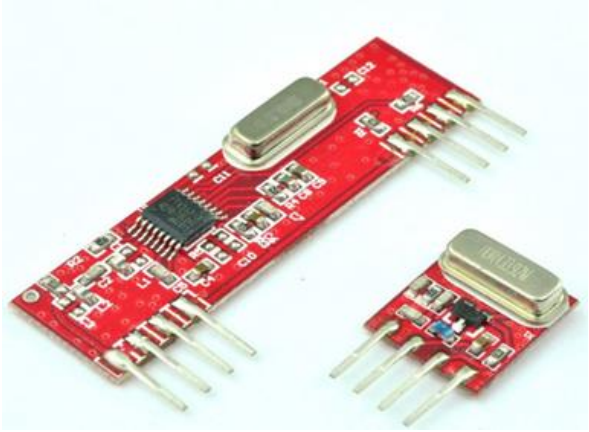

Fig 2. RF Transmitter & Receiver Modules.

1.RF Transmitter:

An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro controller which will provide data to the module which can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.

2. RF Receiver:

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: super heterodyne receivers and super-regenerative receivers. Super-regenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage. Super heterodyne receivers have a performance advantage over super-regenerative; they offer increased accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in the past tended to mean a comparatively more expensive product. However, advances in receiver chip design now mean that currently there is little price difference between super heterodyne and super-regenerative receiver modules.

B. ARDUINO

Arduino is one type of open source microcontroller on the ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE.

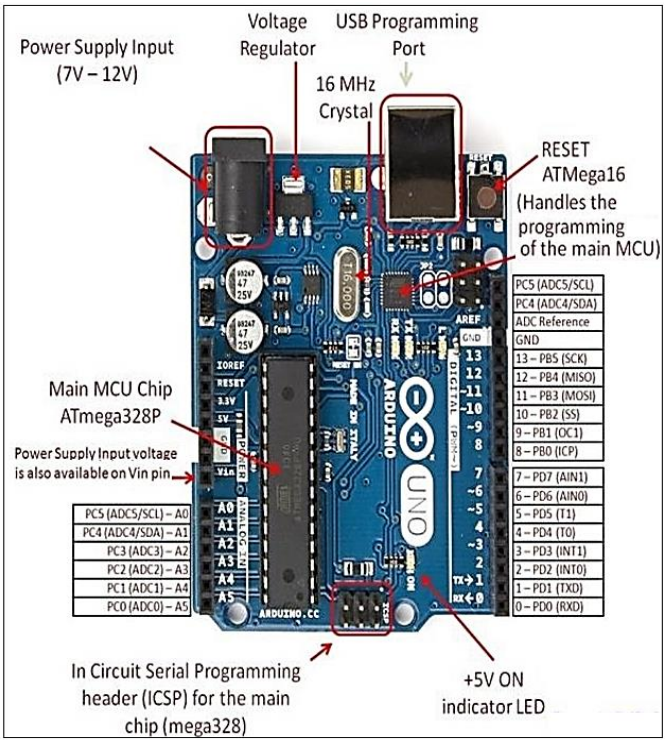

Fig.3. Arduino PIN Diagram.

LED: There is a built-in LED driven by digital pin 13.When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

VIN: The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.

3V3: A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND: Ground pins.

IORef: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the
5V or 3.3V.

Reset: Typically used to add a reset button to shields which block the one on the board.
Serial: pins 0 (RX) and 1 (TX). Used to receive (RX)and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
External Interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
PWM (Pulse Width Modulation) 3, 5, 6, 9, 10, and 11Can provide 8-bit PWM output with the analogWrite() function.
SPI (Serial Peripheral Interface): 10 (SS), 11 (MOSI),12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library. TWI (Two Wire Interface): A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
AREF (Analog Reference: Reference voltage for the analog inputs.
Special Pin Functions
Each of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function

C.HT12E:

HT12E is an **encoder integrated circuit** of 2^{12} series of encoders. They are paired with 2^{12} series of decoders for use in remote control system applications. It is

mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. It converts the parallel inputs into serial output. It encodes the 12-bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits. It has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops.

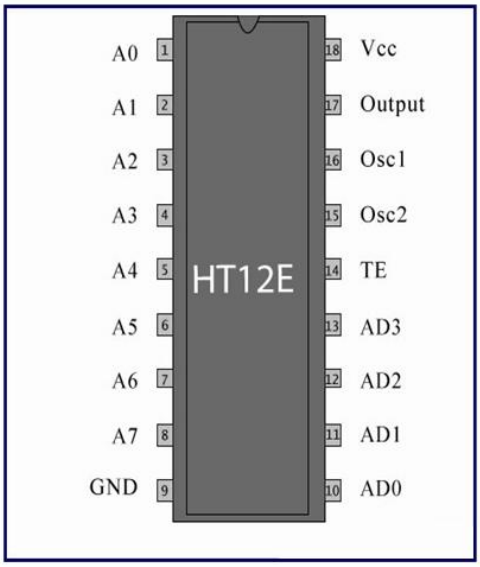

Fig 4. PIN Diagram of HT12E.

D.HT12D

HT12D is a **decoder integrated circuit** that belongs to 2^{12} series of decoders. It is mainly provided to interface RF and infrared circuits. They are paired with 2^{12} series of encoders. The chosen pair of encoder/decoder should have same number of addresses and data format. It converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin. It is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits. The data on 4-bit latch type output pins remain unchanged until new is received.

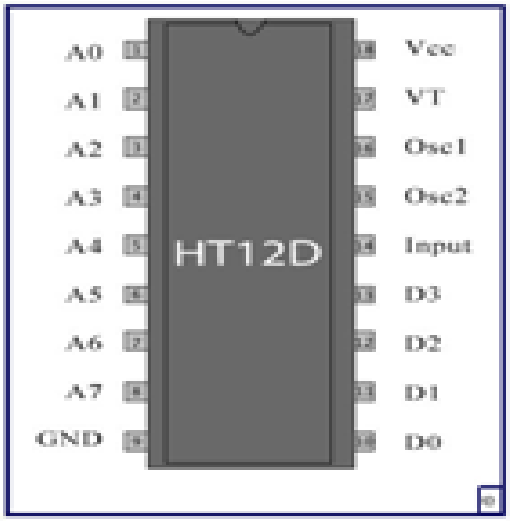

Fig.5. PIN Diagram of HT12D.

E.IR OBSTACLE AVOIDANCE SENSOR

The Infrared Obstacle Avoidance Sensor has a pair of infrared transmitting and receiving sensors. The infrared LED emits Infrared signals at certain frequency and when an obstacle appears on the line of infrared light, it is reflected back by the obstacle which is sensed by the receiver. When the sensor detects an obstacle, the LED indicator lights up, giving a low-level output signal in the OUT pin. The sensor detects distance of 2 - 30cm. The sensor has a potentiometer which can be adjusted to change the detection distance.

Fig.6. IR Obstacle Avoidance Sensor.

F.RELAY

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. A relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier. Relays are usually SPDT (single pole double through switch) or DPDT (double pole double through switch) but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.

Fig7.: JQC 3FC Relay.

G. DC GEAR MOTOR

A gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output. The most important parameters in regards to gear motors are speed (rpm), torque (N-m) and efficiency (%).

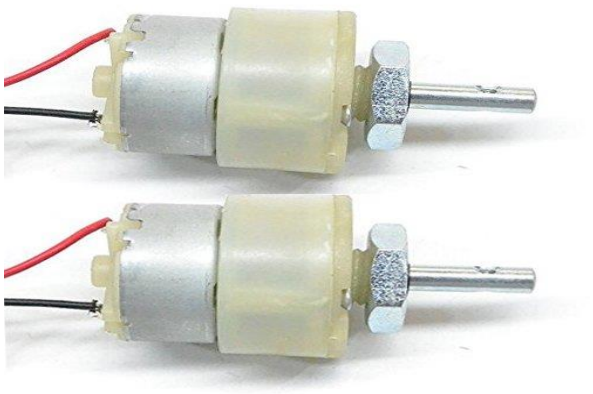

Fig.8. DC Gear Motor.

H. LCD DISPLAY

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

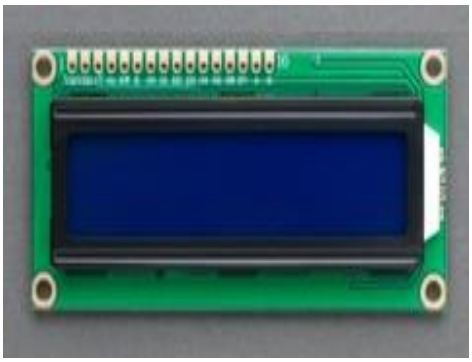

Fig 9: 16x2 LCD Display.

III. RESULTS AND DISCUSSION

Now, we should upload the program which was written in "**ARDUINO SOFTWARE** to the Arduino UNO by using a **"DATA CABLE**". Now if any vehicle enters into a speed restricted zone with speed greater than the zone speed then the speed will be reduced to the specified zone speed.

IV. CONCLUSION

The transmitter system at speed sign post will transmit the signal continuously and the receiver system will receive that signal whenever the vehicle enters the specified speed zone. Then the speed of the vehicle will be regulated according to the zone speed. If no zone is detected by the receiver system, then the vehicle will run without any speed restriction.

V. ACKNOWLEDGMENT

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