

Vehicle Pollution Detection and Speed Reduction System using RFID Technology

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ABSTRACT

Now a days the drivers drive vehicles at fast even in speed restricted regions without considering the security of people in general, the traffic police can't handle them with full impact. Our project focuses on automatic controlling vehicles at speed-limited regions like schools, hospital zones etc. Likewise, it is anything but reasonable to screen these regions all through. This paper clears way for controlling the speed of the vehicles inside certain cut off in limited zones without interference of the drivers. The RFID reader is attached along with the vehicle and the RFID tag with these zones. These tags are programmed to convey a coded message when the reader comes in range. At whatever point the vehicles go into these zones their recipients will get this code and the speed of the vehicles is controlled consequently with the assistance of the microcontroller unit present inside the vehicle. The tags are put toward the start and the finish of the areas for which the speed should be reduced. Pollution has a significant part in the degradation of our planet. The transportation sector is a main source of air pollution in urban cities, and noise pollution is a phenomenon that affects millions of people. This project uses gas sensors located at the vehicle's exhaust, to measure pollution limits in real time, and microphone module to a suitable db level. The information collects check the standard limit and warning message sent to person and also to the vehicle operator via cloud using Internet of Things.

Keywords: RFID (Radio Frequency Identification), Over speeding, Speed control, RF (Radio Frequency), ATMEGA328

I. INTRODUCTION

As far as automobiles are concerned, safety is very important to reduce the occurrence of accidents in speed-restricted zones. It minimizes the loss of

property and life. Therefore controlling vehicle speed has been a crucial issue to be considered [1]. The purpose of this operation is to increase a device to discover rash driving on highways and to alert the site visitor's government wirelessly about the rate

information and any pace violation. Problems like over speeding, rash driving can be solved by installing a speed limiter system [2]. This framework needs to work 24x7 automatically. The system consists of a transmitter and receiver each of which can be set up on both sides of the road [3]. This automated speed controlling system is built using the microcontroller-based platform of the Arduino Uno board. Here the Arduino is programmed in such a way that, the prescribed speed limit was incorporated in the transmitter unit which transmits the signals, and it was received by the receiver in the vehicle using wireless communication technology and the speed of the vehicle was automatically controlled by the input signals by the receiver, with the help of speed encoder sensor [4]. Air pollution is the greatest environmental threat to public health globally and accounts for an estimated 7 million premature deaths every year. Air pollution and climate change are closely linked as all major pollutants have an impact on the climate and most share common sources with vehicles. To monitor and check real-time air quality in a specific vehicle [5]. Noise pollution is one of the most critical environmental issues that pose multiple adverse effects on urban citizens' health. Noise monitoring and analysis play a vital role in noise management and implementation of noise control strategies an affordable acoustic sensing device supporting NB-IoT communication that can continuously measure sound level and record acoustic events, the back-end system[6].

II. METHODS AND MATERIAL

In our proposed work, we have used different sensors, which perform different tasks. MQ6 sensor is a gas sensor, which is used to detect the hazardous gases. LM393 sensor used to detect noise. Both the noise and gas sensor's data are collected by the Node-MCU microprocessor.

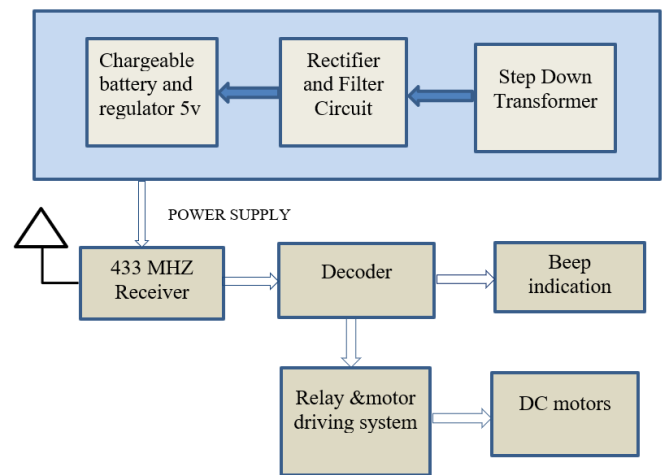


Figure 1(a): Block diagram represents inside vehicle (Receiver module)

Transmitter is placed at zones like school zone, hospital zone. This transmitter will transmit rf signals. The transmitter block includes the electricity supply, zone speed indicator, encoder, RFID Transmitter. For electrical supply we use solar panels and battery for storage purpose and receiver tag is attached to a respective vehicles ,whenever the vehicles enter this limiting zones signals will received by receivers. Receiver block diagram consists transformer, rectifier, and microcontroller, motor. Inreceiver side it receives the speed of the car from speed encoder so that the vehicle speed can be reduced. Arduino UNO as a microcontroller and chargeable battery. Rectifier The input of the rectifier is Ac and it converts the Ac to 5 V DC Voltage regulator is used to preserve regular the 5 volt to the microcontroller. Microcontroller Input of the microcontroller is 5V DC and the output of the microcontroller is pulse width modulation which is given into the motor thru the motor driving force to govern speed of the motor depending upon the cars speed. By using this device, from the transmitter side signals are received according to the signal the vehicle speed are reduced mechanically. The DC motor sensed the speed of the car and the output from the dc motor is fed to microcontroller. This microcontroller will compare the car speed with the limited speed.

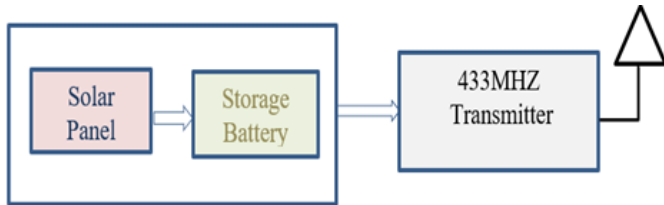


Figure 1 (b) : Block diagram represents at the zones (Transmitter module)

MQ135 is gas sensor that detects presence of flaming gases, which is placed at vehicle emission. Noise sensing module will detect the noise. ESP8266 12-E Node MCU kit connect the sensors and data transfer using WIFI. Collected data will be displayed using BLYNK IoT Cloud transferred the alert communication to the specific stoner if the CO emigration position from the vehicle crosses the needed threshold position.

Micro Controller (ESP8266 (Node-MCU)):



Figure 2: Node MCU

Node MCU is an open source IOT platform. It includes firmware, which runs on the ESP8266 Wi-Fi SOC from Express if Systems, and hardware, which is based on the ESP-12 module. The term "Node MCU" by default refers to the firmware rather than the development kits. The firmware uses the Lau scripting language. It is based on the Lau project, and built on the Espressif Non-OS SDK for ESP8266.

Relay Board



Figure 3: Relay Board

Relay Board Electromagnetic Relays are an electromechanical switch that is used to switch ON or OFF a circuit with the help of the electromagnet. Electromagnetic relays work on the principle of magnetic attraction. It works similar to the contactor, but a low range of the ampere as compared to the contactor. Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relay with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but we can solder wires directly to the pins providing we take care to avoid melting the plastic case of the relay. Relays are used in a wide variety of applications throughout industry, such as in telephone exchanges, digital computers and automation systems. Highly sophisticated relays are utilized to protect electric power systems against trouble and power blackouts as well as to regulate and control the generation and distribution of power.

DC Motor 60 RPM



Figure 4: DC motor

An Electric motor is an electrical device which converts electrical energy into mechanical energy. The basic working principle of a DC motor is: "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force".

The direction of this force is given by Fleming's left-hand rule and its magnitude is given by $F = BIL$.

Where, B = Magnetic flux density,

I = Current flowing through the conductor

L = Length of the conductor within the magnetic field.

Lead Acid Battery

A 6-Volt battery, which is commonly known as lantern battery is a lead-acid type cell that is made up of a collection of four larger cells, usually D batteries with 1.5V per cell. With this composition, 6-Volt Batteries offer a wider space for energy storage and thicker plates for sturdiness that can last for longer usage.



Figure 5: Lead Acid Battery

Moreover, most 6V batteries are recycled to maximize its capacity to store and to discharge energy suitable even for a low-cost budget, making it a great choice especially to motorists and electricians as it extends the cycle of charging and discharging.

Nine volt batter



Figure 6: Nine volt Battery

The nine-volt battery is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts. A very common size is known as PP3, connected to solar panel for electrical energy storage and used for transmitter to send signals.

Solar panel



Figure 7: Solar Panel

Solar power is arguably the cleanest, most reliable form of renewable energy available, and it can be used in several forms to help power appliances. Solarpowered photovoltaic (PV) panels convert the sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. This electricity can then be used to supply renewable energy to battery, by lowering utility bills, these panels not only pay for themselves over time, and they help reduce air pollution caused by utility companies. We chose a solar panel of 10W.

MQ6 Sensor

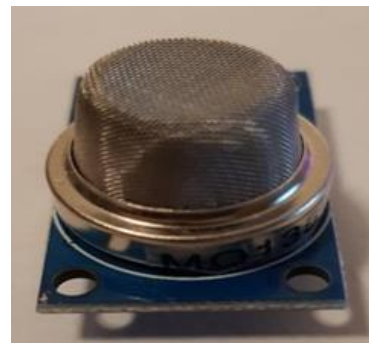


Figure 8: MQ6 Sensor

The MQ-6 Gas sensor can detect or measure gases like LPG and butane. The MQ-6 sensor module comes with

a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers.

LM393 sensor



Figure 9: LM393 Sensor

This sensor emits a signal if the microphone of the sensor detects a noise. The sensitivity of the sensor can be adjusted by means of a controller.

Transmitter

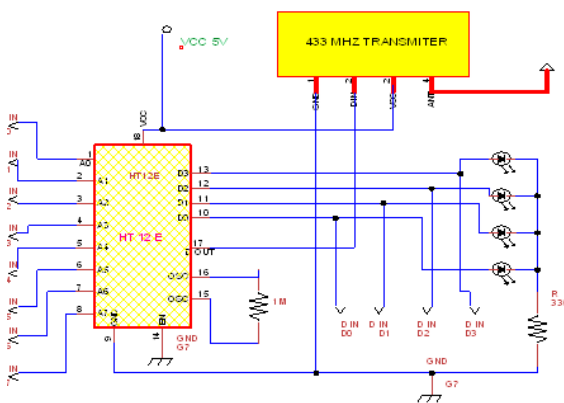


Figure 10: 433MHz with Encoder Circuit

To send the information wirelessly from the source to the destination transmitter is used which are tuned at 433MHz and supported with encoder HT12E. The transmitting unit is connected with sensor circuit, op

amp circuit, or any other user interaction inputs(keys) which has to be sent wirelessly HT12E encoder CMOS, ICS with working voltage range of 2.4v to 12v. Encoder HT12E has eight address and 4 data lines. The data is set on 4 data lines is serially transmitted when transmit enable (TE) is low. The data output appears serially on D OUT pin. The encoder circuit converts parallel signal (d0, d1, d2, d3)To serial and the same is transmitted through transmitter. The receiver receives serial data, and same data goes to Decoder circuit converts serial signal to the parallel and Can be used for controlling purpose.

Receiver

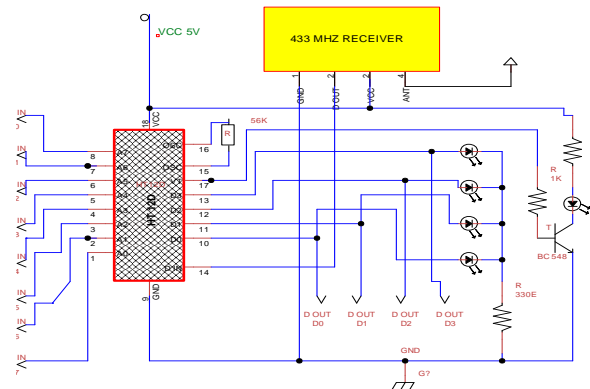


Figure 11: 433MHz with Decoder Circuit.

The receiver unit receives the signal and that can be connected to the, microcontroller, relay circuit, LCD display circuit, voice announcement or any other controlling device. The Receiver CKT is arranged as shown above. The 433MHz RF receiver (ASK type) gets the data from antenna & the serial data is available at its data O/P pin. The corresponding +Vcc & GND pins are connected to +5V source.HT 12D Decoder decodes the serial data to parallel & it is available at D1- D4 data bits the oscillating resistor of 51K is connected to its oscillating pins (pin 15 pin16) Pin 17 is considered as going high when Transmitter starts generating & sending RF wave the pin 17 is connected to a transistor & an LED which glows & indicates the link between Transmitter & Receiver. If a data bit of 1010 is applied to the D0-D3 of HT 12E is Transmit serially. Transmit 433MHz & now through

Transmitter & Receiver receives the data bits & HT 12D decodes the serial data bits to parallel & the same data i.e. 1010 is available at D1-D4 pins of HT 12D. The decoder outputs are connected to microcontroller, LCD, relays or motor driver circuit.

III. RESULTS AND DISCUSSION

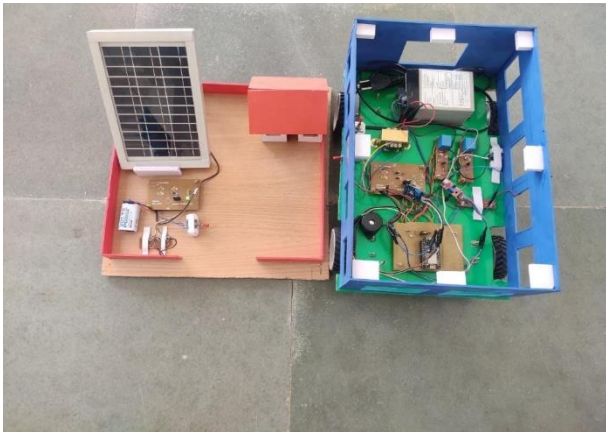


Figure 12: Working Prototype

In this project, vehicle Pollution detection and Speed reduction system using RFID technology, there are four main objectives. First objectives such as the Receiver on the vehicle, which receives signals and reduces the speed of vehicle. Second objective is Transmitter works on the solar energy, which acts as non-conventional energy, which is freely available in the environment. Third objective is vehicle air pollution level detection and reporting it to the person and Authorities. Fourth objective vehicle noise pollution level detection and reporting it to the person and Authorities.



Figure 13: Solar Powered Transmitter Model

The Transmitter in this project is operated based on the non-conventional energy that is solar energy which is get charged through the sun radiations which falls on the solar panel. Presence of photovoltaic cells on the solar panel which helps to convert the solar energy into electrical energy. This electrical energy which is get stored in the battery which is attached to transmitter. The level of energy in the panel can be measured through multimeter. In-case of rainy season the transmitter transmits the signals through the electrical supply which is comes from battery.



Figure 14: Receiver Model

Vehicle speed reduction is second objective of our project. Vehicle has Receiver antenna which will receive signals from transmitter at zone and this receiver is connected to relay and to the dc motors. When it receive signals, relay get On and it will reduce speed of vehicle by reducing a dc motor speed to half of its speed and generate beep sound at zone area. After crossing zones receiver will not receive signal then relay will be in Off condition. as shown in figure 14, MQ6 sensor and LM393 sensor is also in vehicle.

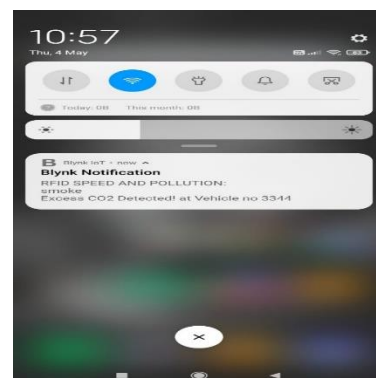


Figure 15:Alert Messgae of Vehicle's Excess Gases Detection

MQ6 is the gas sensor, which is used to detect the air pollution which limit is set to 7000 ppm placed at vehicle exhaust. If it exceeds its limit then, As shown in fig 15, the notification will be given to the authority as well as to the registered mobile number of the vehicle owner to indicate that the air pollution of the vehicle has been exceeded its limit.

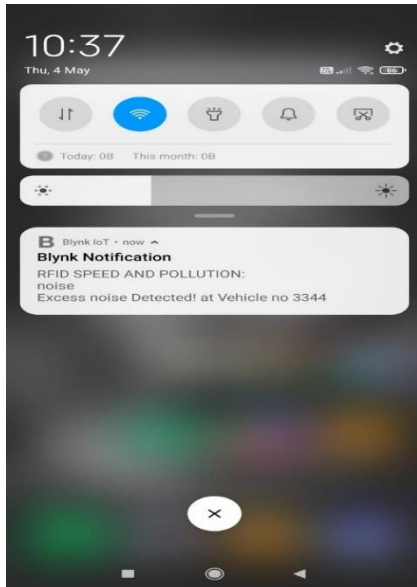


Figure 16:Alert Messgae of Vehicle's Excess Noise Detection

LM393 is the sensor used to detect the sound pollution of the vehicle, which is set to 60db. If it exceeds its db level then, As shown in fig 16, the notification will be given to the authority as well as to the registered mobile number of the vehicle owner to indicate that the sound of the vehicle is exceeded its limit.

IV. CONCLUSION AND FUTURE SCOPE

As increasing automobiles, safety is very important to reduce the occurrence of accidents in speed restricted zones, in the past few years, an accident near the school zones, hospital zones and sharp turnings have increased tremendously. Therefore controlling vehicle

speed has been a crucial issue to be considered. The Risky zones like schools, hospitals. Air pollution is the greatest environmental threat to public health globally, and noise when it becomes continuous and above the threshold limits of the ears . Noise has different types including impulsive noise, continuous noise, intermittent noise and low frequency noise. All above mentioned types of noise are dangerous to human and animals. This paper has an RFID tag which indicates the vehicle when it enters a speed limit zone. The RFID tool alerts the driver when he or she is driving near the speed restrict zone. The speed of the vehicle can be maintained in the limited speed without the intervention of the driver and also produce beep sound inside vehicle to alert the driver. If this can be implemented effectively rash driving and over speeding in the speed limit zones can be reduced to a large extend, thus decreasing the total number of road accidents in our country. Vehicle air pollution and noise pollution level monitoring and reporting it to the authorities.

Future Scope

This system proves to be highly effective in minimizing the over speeding and unwanted accidents in restricted zones. In current systems, there is no autonomous speed restriction in the vehicle to avoid accidents. Hence further research and optimizations of the automatic vehicle speed control system will allow us to implement in vehicles for improved safety for roadside pedestrians, passengers, and other road users.

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