Intelligent Smart Zone Based Vehicle Speed Control System Using RF

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***Abstract*—**The project focused in designing a system which can provide the high security monitoring and controlling for particular busy zones with wireless communication. This system automatically controls the vehicle speed at particular. Whenever the RF receiver receives signals from RF transmitter which is placed at the school zone then it sends the information to the microcontroller. The microcontroller is programmed in such a way that it gives a beep sound indicating that the vehicle has entered the school zone and then the vehicle speed is reduced based on the zone. whenever robot senses any obstacle, then the robot stops and change its direction.

Keywords*—Microcontroller; RF; monitoring; robot; obstacle;*

I. INTRODUCTION

Intelligent instruments are being used in every part of our lives. It won't take much time to realize that the most of our tasks are being done by the electronics. They will perform one of the most complicated tasks which a person does in a day, that of driving a vehicle. As the days of a man driving are getting extremely numbered, so are those of traffic jams, dangerous and rough drivers and more importantly, accidents.

Road facilities are major concern in the developed world. Recent studies show that one third of the number of fatal or serious accidents are associated with the excessive or inappropriate speed, as well as changes in the roadway (like the presence of road-work or unexpected obstacles). Reduction of the number of accidents and mitigation of their consequences are big concern for traffic authorities, the automotive industry and transport research groups.

This Usage of wireless RF technology to detect the areas where speed should be controlled. Speed of the vehicle is reduced while in smart zone. The designed system is equipped with speed reduction system and obstacle detection system. This system is useful for smart zones like Hospital, School, Colleges etc. One RF transmitter will be placed in front of the smart zone. One RF receiver attached with the microcontroller will be placed inside the vehicle.

The RF receiver, over detecting the RF transmitted signal will send signal of speed reduction to the microcontroller along with a BEEP sound. The speed of the vehicle will be controlled through Microcontroller (Arduino NANO). If any sudden obstacle comes in front of the vehicle, an IR sensor (placed in front of the bus) will detect the obstacle and will send signal to the Microcontroller to stop immediately.

The controlling device of the whole system is a Microcontroller (Arduino Nano) to which RF receiver module, wi-fi module, buzzer, IR sensor, DC motors are interfaced through a motor driver.

The Robot consists of two DC motors, which controls the side pair wheels of each and help in moving forward and backward direction. Robot senses the object with help of an obstacle sensor. IR pair is used for detecting the obstacle. The wi-fi module is used to send information graphically when it comes across any obstacle or school zone. The IR transmitter sends an infrared signal that, in case of a reflecting surface, bounces off in some directions including that of the IR receiver that captures the signal detecting the object. When the surface is absorbent the IR signal isn't reflected and the object cannot be detected by the sensor. This result will occur even if the object is absent. We will use Thingspeak server to visualize this data. ThingSpeak server is an open IoT platform with MATLAB analytics which is used to visualize the data.

These systems are somewhat available in the commercial vehicles today, and future trends indicate that higher safety will be achieved by the automatic driving controls and a growing number of the sensors both on the road infrastructure and the vehicle itself.

II. AIM OF THE PROJECT

- Usage of wireless RF technology to detect the areas where speed should be controlled.
- Speed of the vehicle is reduced while in smart zone.

III. COMPONENTS AND SOFTWARE

- **Arduino Nano:** Arduino Nano is a Microcontroller based on ATmega328p. Arduino Nano can sense the environment by receiving the input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller placed on the board is programmed using the Arduino programming language.

- **16X2 LCD Module:** An LCD (Liquid Crystal Display) screen is an electronic display module. The 16X2 LCD displays unit's data pins D4 to D7 are interface to the port are p0.16 to p0.19 of the controller for data receiving and controlling process. The interfacing ports are getting the data and

displaying on the LCD display. RS-Reset pin interfaces to the port of p1.16 and EN-Enable pin interfaces to the port of p1.17.the read and write pin are connecting to the ground. This reset enable pin is used to display the receiving data.

- **Encoder:** Encoder is used to generate the digital data which need to be transmitted. The encoder integrated circuit has 8-address lines and 4-data lines. The encoder used in the project is HT12E.

- **Decoder:** Decoder is used to decode the required data from the received data. The decoder integrated circuit has 8-address lines and 4-data lines. The decoder used in the project is HT12D.

- **RF Transmitter and Receiver:** This is an ASK Hybrid Transmitter and receiver module operates at 433 MHz frequency.
  Transmission Channel: 434Mhz
  Range: 60m
- **Arduino IDE:** The Arduino IDE (Integrated Development Environment) contains a text editor for writing the code, a message area, a text console and a toolbar with buttons for common functions and a series of menus. It works as a connection to the Arduino hardware to upload programs and communicate with them.

- **IR Obstacle Sensor:** IR sensor is used to detect obstacles.

- **DC Motor with Driver:** The DC motor is an electric motor that works on Direct Current (DC).
  Motor supply: 9-15V DC.
  Microcontroller cannot run the motor in both directions and it is not capable of driving the motor when it is directly connected to it. So, motor driver L293D (H-bridge IC) is used as an interface between motor and Microcontroller.

- **Wi-Fi Module:** WIFI Module is a microchip with full TCP/IP stack and Microcontroller capability. The Wi-Fi Module we used in the project is ESP8266.
  Type: 32-bit Microcontroller
  CPU: 80Mhz (default) or 160Mhz
  Memory: 32Kib instruction, 80Kb user data

IV. INDIVIDUAL MODULES

In the transmitter section we used micro switches as an input signals and these signals are encoded by the encoder and later encoded signals are transmitted through the transmitter. Block diagram of the transmitter section is shown in the figure 1.

The RF transmitter output is up to 8mW at 433.92MHz with the range of approximately 400foot (open area) outdoors. Indoors, approximately the range is 200 foot, and will go through most walls. The transmitter accepts both linear and digital inputs can operate from 1.5 to 12 Volts-DC, and makes building a miniature hand-held RF transmitter very Easy. The transmitter is approximately 1/3 the size of a standard postage stamp.

A. Transmitter

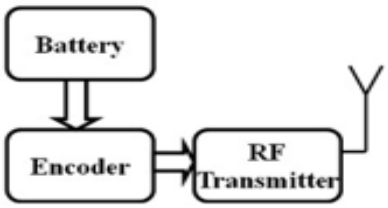


Fig 1: Block Diagram of Transmitter

In the receiver section, RF receiver receives transmitted signals and decodes those signals by using the decoder logic and later sends it to microcontroller. By using microcontroller the decoded signals will be displayed on LCD. Then the data or information sends it to the DC motor 1 & 2, by using DC motor drivers which is connected to the microcontroller. The block diagram of the receiver section is shown in figure 2.

B. Receiver

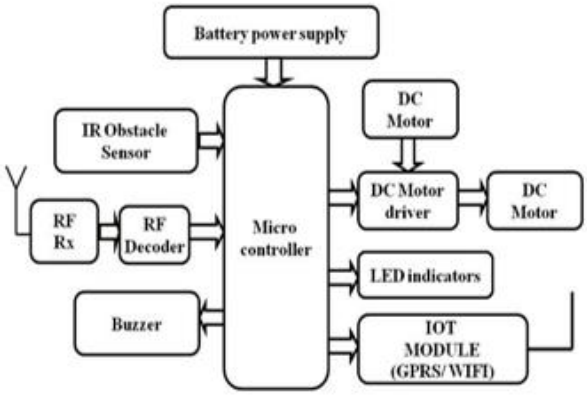


Fig 2: Block Diagram of Receiver

C. Buzzer Section

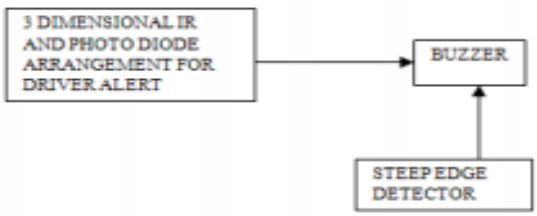
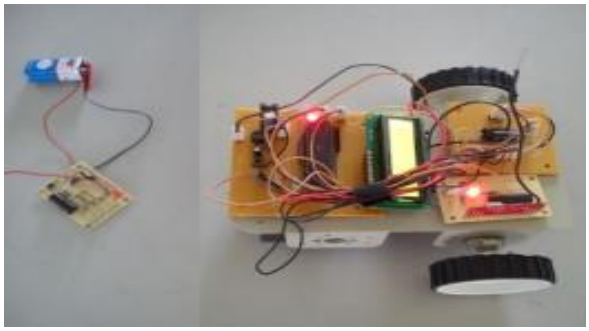


Fig 3: Block Diagram of Buzzer Section

V. MAIN MODULE



The modules in the project we use are: RF transmitter and RF receiver for establishing the wireless communication, to control the vehicle movements we used DC motors and IR Sensor for detecting Obstacles.

The controlling device for the entire system is a Microcontroller to which RF receiver module and DC motors are interfaced through a motor driver (i.e., L293D). The Microcontroller performs appropriate actions by checking the data with the program embedded in it. The Embedded C language is used to program the Microcontroller. Whenever a vehicle enters into the transmitted zone the vehicle receives a signal and the speed will be reduced to cut-off and maintained in constant speed until the vehicle moves out from the transmitter zone and then the vehicle can get accelerated by itself.

The IR sensor will detect any obstacle occurs in front of vehicle and sends information to the Microcontroller and then Microcontroller interacts with the IC driver to take appropriate directions to prevent accidents.

Every embedded system requires dc voltage and that that will be 5v DC supply. So, the battery voltage need to converted to 5V dc. Digital electronic devices need digital supply and we can get supply from regulated power supply block Rectifier is used to protect the circuit from battery polarity reversal.

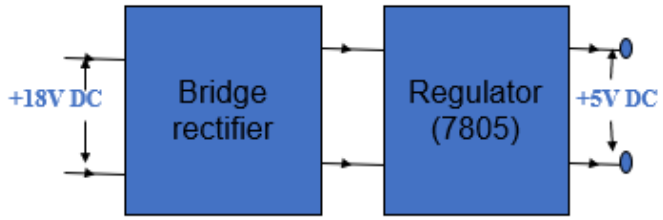


Fig 4: Regulated Power Supply

VIII. ADVANTAGES

- Speed Controlling using PWM
- Speed Control through RF technique
- U curves Safety Indications
- Less man power is required
- Speed control at humps
- Automated smart zone locator
- Usage of Wireless RF technology
- Low power consumption

The aim of this research is to build a sensor system for the infrastructure to vehicle (l2V) communication, which can transmit the information provided by active signals placed on the road to adapt vehicle's speed and prevent collisions. This information is collected in real time by RFID sensors placed on the board of a vehicle which we have modified to automatically change its speed to adapt to the circumstances of the road.

VI. WORKING

This project is developed based on the EMBEDDED and RF Technology. Whenev a vehicle enters into a Smart Zone then the signal will be detected by the Rx which was transmitted by the Tx already placed in the Zone. The Signal received will be decoded by the microcontroller and alerts the driver through a LCD Screen. According to the signal received by Microcontroller controls the DCMotor Speed after a few seconds from the time it received the signal.

VII. CIRCUIT DIAGRAMS

A. Transmitter

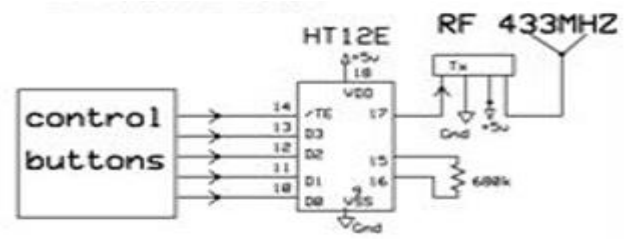


Fig 5: Schematic Diagram of a RF Transmitter

B. Receiver

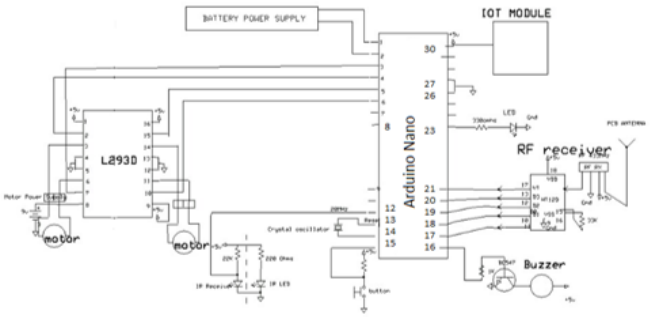


Fig 6: Schematic Diagram of RF Receiver

IX. APPLICATIONS

- Industries using RF solutions for monitoring, process, control, inventory tracking, data links and bar code reading devices.
- Commercial wireless applications such as the door announcers, security and access systems, gate control, remote activation, score board and paging systems.

X. FUTURE SCOPE

We can implement using GSM and GPS to know the speed and location of a vehicle to smart mobiles at home or vehicle owner and traffic also.

XI. CONCLUSION

This project explored the heavy traffic zone accident preventions technique in the real world. The heavy traffic zone are schools, hospitals, Highways, U-turn etc. There the vehicle speed will be controlled automatically without the help of the driver. At the same time, it also detects obstacle and stops the vehicle, so that accident will be prevented and there is no need of speed controller (police). This can provide the high security monitoring and controlling for particular busy zones with wireless communication.

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