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A Modern Approach of Vehicular Pollution Monitoring and Speed Control

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Abstract: ***Nowadays the use of vehicles in this era is eventually increasing. Because of this reason, the pollution and accidents are enormously increasing. A very few measures are taken to avoid and control the pollution and accidents caused by the vehicles. Accident control measures are also not properly followed. So we propose a mechanism to avoid and control pollutions such as Air pollution and Noise pollution. Accident control is achieved by enabling speed control mechanism for vehicles on different zones. By using RFID communication we can control the DC motor speed and direction. The Internet of Things (IoT) is constantly evolving and is giving unique solutions to the everyday problems faced by man. We deploy the concept of integrating different case situations in this project. We use IoT to constantly update the details of actions performed by the vehicle.***

Keywords: ***RFID (Radio Frequency Identification), IOT (Internet of Things), PIC Microcontroller, speed control, air and noise pollution, accident, vehicle.***

I. INTRODUCTION

Air and sound pollution is a growing issue these days. It is necessary to monitor the air quality and keep it under control for a better future and healthy living environment. Here we propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in a particular areas through IOT and also automatic speed control system allows us to reduce the speed of vehicle in a particular zones to avoid major or minor accidents through RFID. System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data to microcontroller. Also system keeps measuring sound level and reports it to the online server over IOT. Also reads the speed of the vehicle approaching the particular zone.

The sensors interact with microcontroller which processes this data and transmits it over internet. This allows authorities to monitor air pollution in different areas and take action against it. Also authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue.

Road transport has been a major concern in the ever developing world. This can be proved by the statistics presented by the Association of Safe International Road Travel (ASIRT). According to them, road traffic crashes rank as the 9th leading cause of death and account for 2.2% deaths globally. These amount to USD $518 billion globally, costing individual countries from 1-2% of their annual GDP. They also predict that unless action is taken, road accident injuries can become the fifth leading cause of death by 2030.

II. METHODOLOGY

In the existing system only the visible problems are resolved. The existing system just indicates the pollution caused by the vehicles. No actions are performed to control or avoid the pollution caused by the vehicles. Remote access of status of the vehicles is not accessible .In the proposed system, to avoid noise pollution we enable the use of RF transmitter to sends a signal to the nearby vehicles. The RF receiver placed in the nearby devices will sound the buzzer, when they receive the transmitted signal. Now the device which receives the signal starts sounding the buzzer, thereby reducing the noise pollution to some extent. To avoid accidents, we install an RFID transmitter device in every zone. So when the vehicle approaches near the zone, the RFID reader gets a signal indicating the maximum speed up-to which the vehicle can run in that zone. Based on the signal, the DC motor is controlled by the driver circuit installed to the controller. A smoke sensor is used to detect the smoke coming out of the vehicle. When the vehicle emits smoke, the buzzer connected to the vehicle starts alarming. An IOT module is used to update these status of the vehicle.

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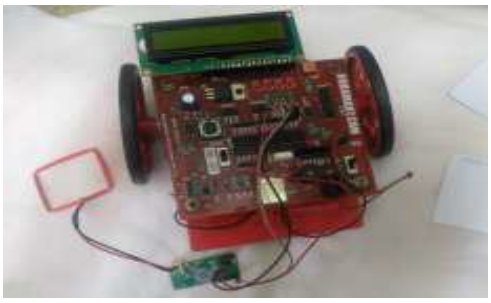

Figure 1: Proposed model of the system

III.BLOCK DIAGRAM

A. *Transmitter section*

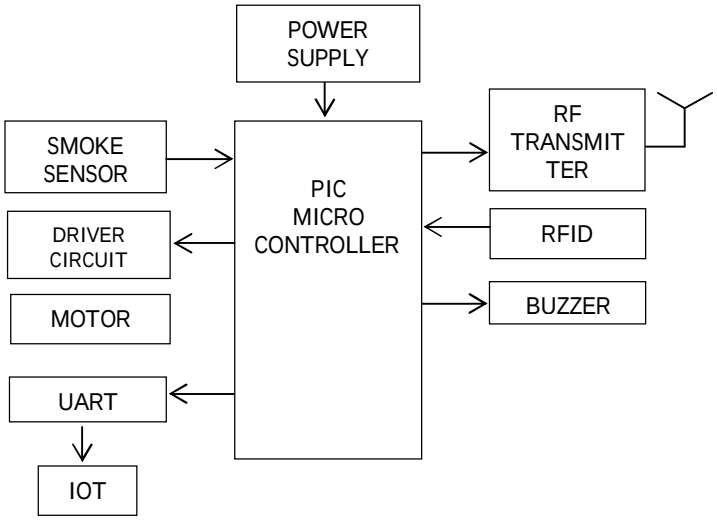

FIGURE -2: Block Diagram of transmitter section

B. *Receiver section*

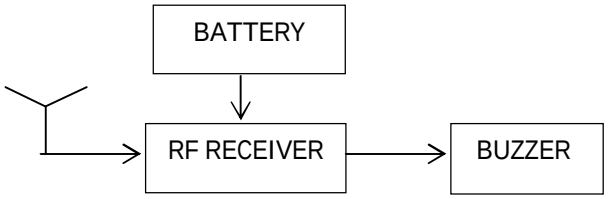

FIGURE -3**:** Block Diagram of receiver section

C. *IOT SECTION*

FIGURE -4**:** Picture of IOT section

1) From the above fig(2), the PIC microcontroller plays a major role in this prototype. The power supply is given to the PIC and a smoke sensor is also connected with it. A motor is connected with PIC through driver circuit. During the transmitter section, the data is transmitted to the PIC via RF Transmitter from the Receiver section. The UART and IOT is also connected serially with the PIC Controller.

2) From the fig(3), the data is received by the RF Receiver from the transmitter section. Here, battery is connected with the receiver to provide power source and also buzzer is connected for intimation purpose.

3) From the above fig(4), the IOT section usually a computer or a mobile can be used. But in our system, we use an android based mobile for storing the status of the vehicle.

IV. HARDWARE DESCRIPTION

A. Power Supply

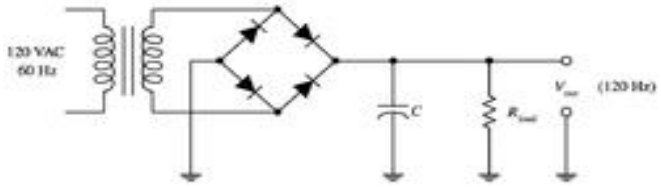

Figure 5: Circuit of the power supply of the system

The power supply given to this circuit is of 230V AC input. DC power supplies use AC mains electricity as an energy source. A rectifier is used to convert the transformer output voltage to a varying DC voltage, which in turn is passed through an electronic filter to convert it to an unregulated DC voltage.

B. Dc Motor

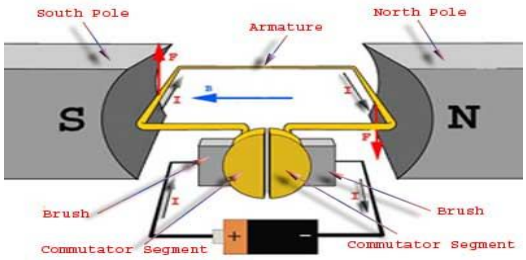

Figure 6: Working principle of DC motor

Wide range speed control. Convert electrical to mechanical power. Higher starting torque. Less electronic and rectification need. Low cost operation. Torque is produced by the principle that any current-carrying conductor placed within an external magnetic field experiences a force, known as Lorentz force.

C. Pic Microcontroller

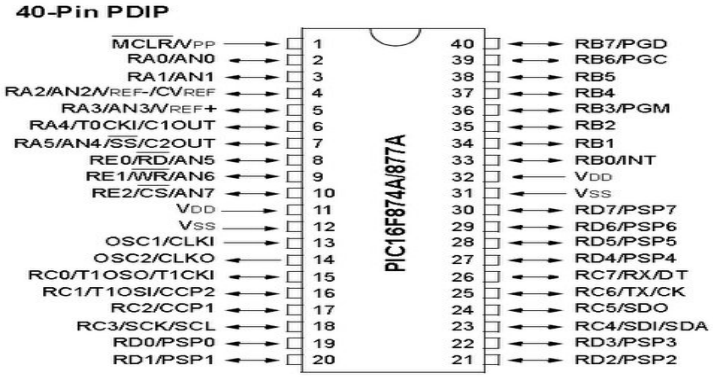

FIGURE 7: Pin Diagram of PIC16F877A

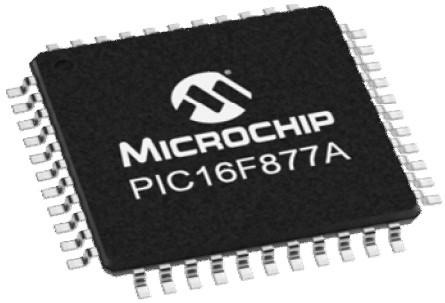

FIGURE 8: Picture of PIC microcontroller

The PIC used in this prototype is PIC16F877A. Low power, high performance microcontroller. Program memory of 4k bytes. 32 programmable I/O lines. Two 16bit timer/counter. Programmable serial UART port. External memory interface. This PIC is mainly used for efficient serial communication with UART pin. It has parallel slave port.

D. Smoke Sensor

Air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory, simply drive and monitoring circuit.

1) *Part Code: MQ135*
2) *Features*
3) High Sensitivity
4) Stable and Long Life
5) Detection Range: 10 - 300 ppm NH3, 10 - 1000 ppm Benzene, 10 - 300 Alcohol
6) Heater Voltage: 5.0V
7) Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - 6mm High

E. Driver Circuit

The driver circuit used is of 500mA rated collector current (Single output). High-voltage outputs: 50V. Compatible with various types of logic. Relay driver application.

F. Buzzer

The input given to buzzer is of 5V DC supply. Some sort of input and emits a sound in response to it. It will intake energy and convert it to acoustic energy. Acquires power directly from the device. Also run on backup power.

G. Uart

A Universal Asynchronous Receiver Transmitter (UART) is a computer hardware device for asynchronous serial communication. Data format and transmission speed are configurable. Uses serial communication and so transmits data in serial fashion. Supports Synchronous operation. It translates data between parallel and serial forms. Here, data is transmitted between PIC and IOT module.

H. Rfid Reader (Rs232)

Gather information from RFID tag and track individual objects. Radio Frequency Waves are used to transfer data from tag to a reader. Automatic Identification and Data Capture method. Voltage supply of 12V(dc) is given.

I. Rf Transmitter And Rf Reciever

Transistor module transmit radio wave and modulate to carry data. Receiver module receives the modulated RF signal and demodulates it. Remote control and vehicle monitoring. Operating frequency is 434MHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

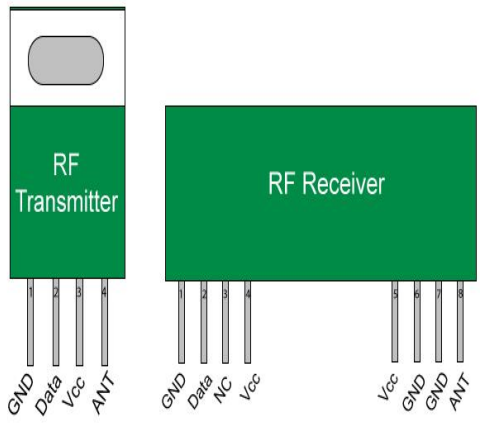

Figure 9: Pin Diagram of RF section

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figure 10: Picture of RF section

J. IOT

Figure 11: IOT Module with ESP8266

Convergence of wireless technology. Updation of data of specific site or network. Auto data updating: 30sec. Featured with SIM900 GPRS mode to activate internet connection. Power supply:12v(dc).

K. Relay

Array of 7NPN Darlington Transistor capable of 500mA, 50v output. High current, high-voltage capacity. For interfacing stepper motor to acquire high ratings. Compatible with TTL and 5-v CMOS logic.

L. LCD Display

Flat panel display or other electronically modulated optical device. Uses light modulating properties of liquid crystals. It displays preset words, digits and seven segment displays. Low power consumption and compact in size. No geometric distortion. Unaffected by magnetic fields, including the Earth's.

V. WORKING DESCRIPTION

In this system, by using IOT and RFID we monitor the air pollution, control the noise pollution and also speed is controlled in a particular zone i.e mainly in School zone, Hospital zone, Accident prone areas. During a particular zone, the IOT updates the air quality of the area. If the area is polluted, then it gives an alarm indicating in the LCD display as "POLLUTION OCCUR" and if not the LCD display as "POLLUTION NOT OCCUR". By this we can monitor and control the air pollution. Next, in order to control the noise pollution in a particular zone, then we install RFID reader in a vehicle. During a sound horn, this sound will be heard only by the surrounding vehicles. So that noise pollution is controlled in a particular zone. At the same time, the speed of a vehicle is controlled by the same RFID Reader installed in a particular place. When a vehicle approaching these region with high speed, the RFID Reader reads the corresponding speed and it sends the data from the RF Transmitter to the RF Receiver. Now, once the vehicle enters the region, then automatically the speed is reduced to a limited value installed in our system. Hence, the accident and death due to these accident is avoided.

SITUATION	AVERAGE SPEED (km/hr)	NOISE LEVEL (dB)
HOSPITAL ZONE	25-30	45 (day time) 35 (night time)
SCHOOL ZONE	30	50
RESIDENTIAL AREA	48	55 (day time) 40 (night time)

TABLE-1: Threshold value

The above table gives the threshold range for a particular zone used in our system. Usually this range is followed in our country.

VI. CIRCUIT DIAGRAM

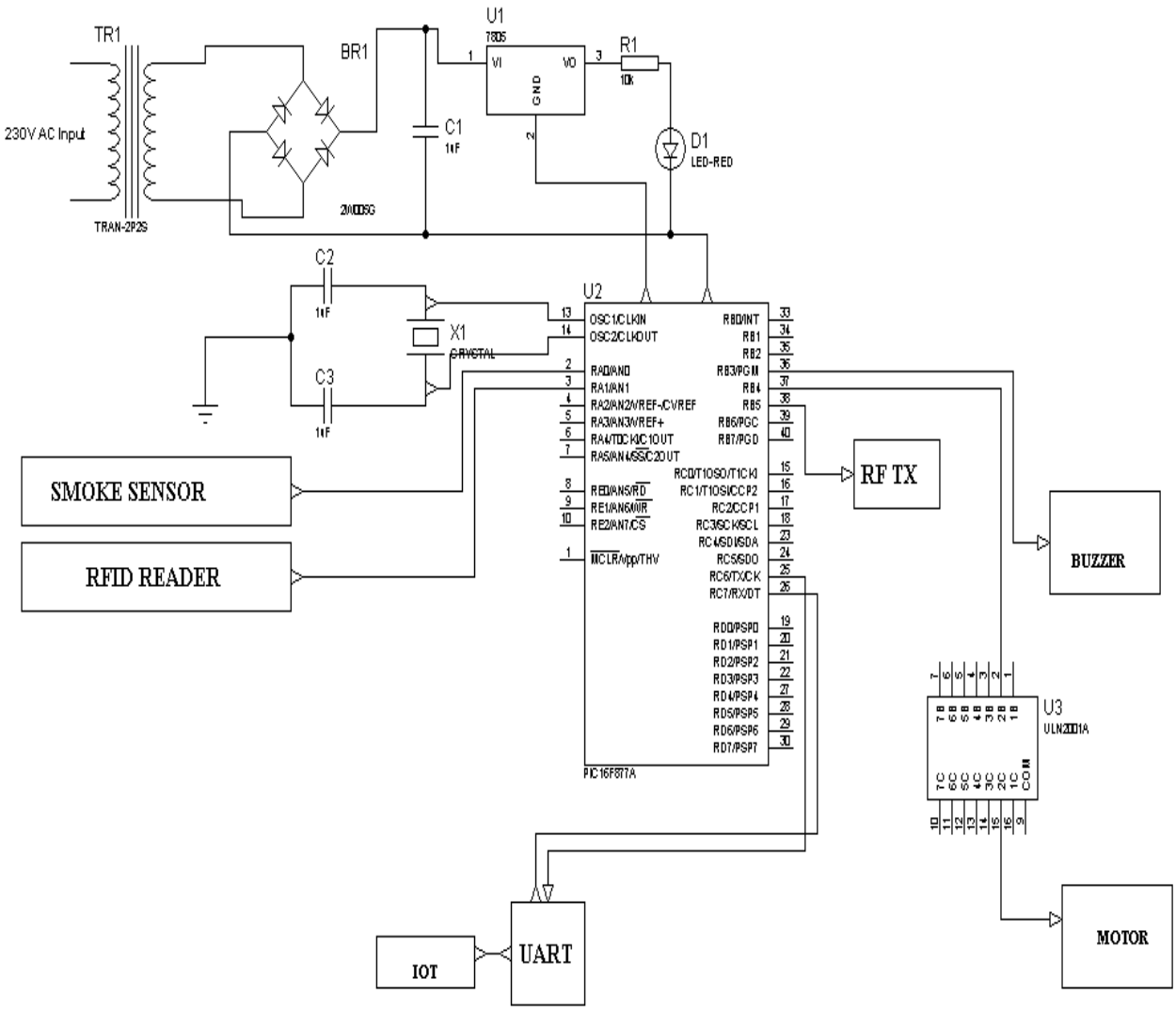


Figure -12: circuit diagram of the system

From the above circuit diagram fig(5), the power supply is given to the PIC. Here, 230V AC supply is stepped down using transformer and a bridge rectifier is used to convert the AC to DC supply. A capacitor connected across the rectifier to store the energy. Voltage regulator connected with it regulates the voltage and which is supplied to the PIC microcontroller. R_1 and D_1 connected to the regulator, control and indicates the supply respectively. The Darlington Transistor array connected to the PIC is plugged with the motor to produce high current and voltage. Crystal oscillator which externally connected to the PIC to give a certain voltage to an external clock to excite it. It maintains the operation time frequency of the system. IOT is connected serially with UART. Smoke sensor, LCD display and buzzer is also connected to PIC.

VII. FLOW CHART

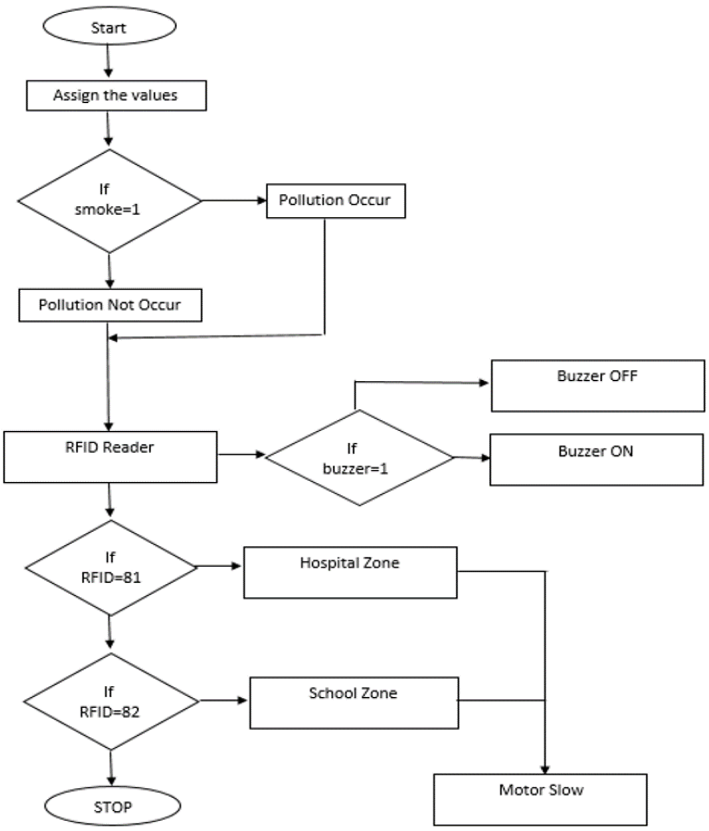


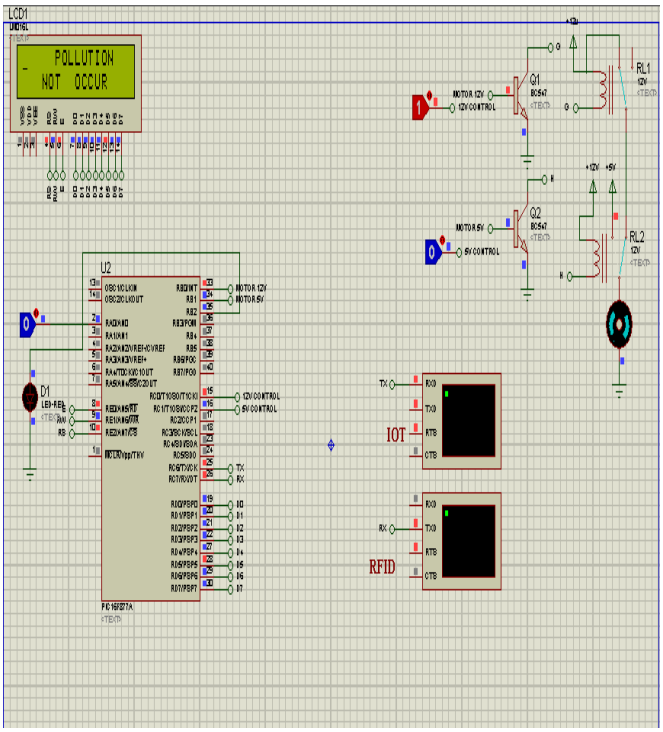
Chart 1: Flow chart of this system

From the below fig(6), shows the flow chart of our system. Here, assign the values for Smoke=1, RFID=81, RFID=82 and Buzzer=1 to our system. When a vehicle enters the region, then check whether Smoke=1, if yes then display “POLLUTION OCCUR”, else display “POLLUTION NOT OCCUR”. Now RFID starts reading the assigned value. For noise pollution, check whether Buzzer=1, if yes then buzzer starts alarming. Again, once the speed range is checked, if RFID=81 then displays “HOSPITAL ZONE” or if RFID=82 then displays “SCHOOL ZONE”. Now during both the above 2 conditions, the speed of vehicle is reduced to a limited range.

VIII. SIMULATION RESULT

The Software used in our system is Embedded C and MPLAB IDE. Embedded code source includes software from a large network of third party developers as well as software developed by Microchip. Premium code with advanced features is used in our prototype. Embedded code source includes PIC MCU code or a wide variety of applications including wireless touch sensing and display drivers. The program instructions written for embedded systems are referred to as firmware, and are stored in read-only memory or flash memory chips. Microchip's 32-bit portfolio with the MIPS and ARM cores offer high performance microcontrollers, and all the tools needed to develop your embedded projects.

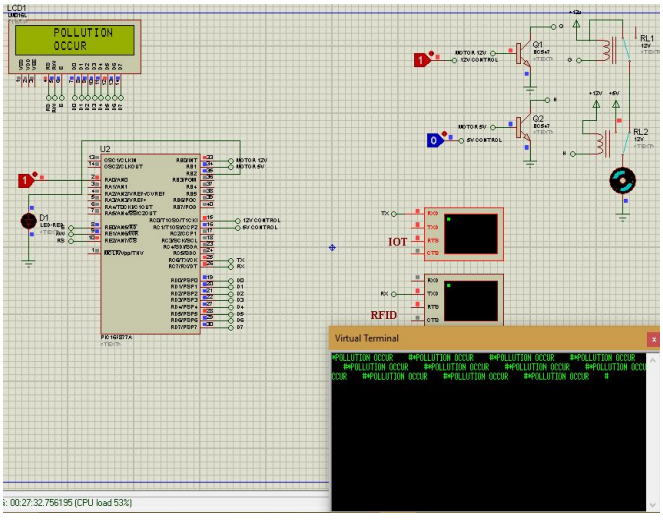
A. Case 1: Pollution Not Occur



FIG(a): Simulation result for pollution not occur case

When a vehicle enters the region, the smoke sensor is used to detect the CO_2 level of these region. Initially, input 0 is given. Here, area is not polluted and so the LCD displays "POLLUTION NOT OCCUR". These status are updated in the IOT for future references. Hence, the air pollution is monitored continuously.

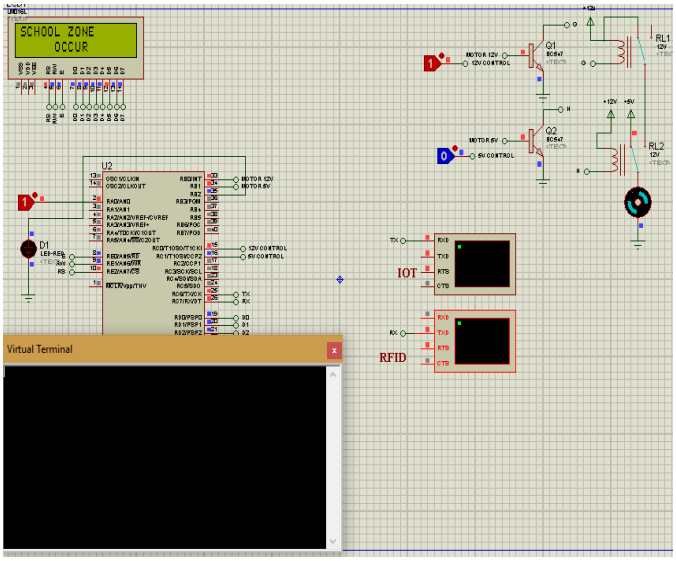
B. Case 2: Pollution Occur



FIG(b): Simulation result for pollution occur case

When a vehicle enters the region, the smoke sensor is used to detect the CO_2 level of these region. Now input 1 is give. Here, the area is polluted and so the LCD displays "POLLUTION OCCUR". These status are updated in the IOT by clicking the virtual terminal for future references. Now once the region is polluted, it also gives a buzzer sound for indicating the polluted region and immediate control action can be taken. Hence, the air pollution is monitored and controlled continuously.

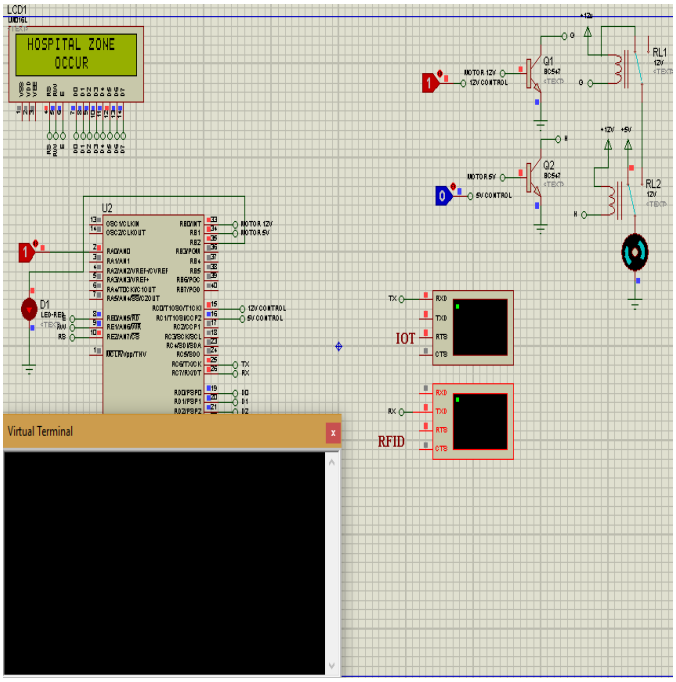
C. Case 3: School Zone (Low Speed)



FIG(c): Simulation result for school zone at low speed case

When a vehicle enters the zone, the RFID Reader reads the corresponding speed and sends the signal. If the vehicle is at high speed, then it reduces the speed automatically. Here, by clicking RFID and typing the assigned value as **82**, the motor speed is reduced and LCD displays as "SCHOOL ZONE". Thus, speed is controlled automatically.

D. Case 4: Hospital Zone (Low Speed)



FIG(d): Simulation result for hospital zone at low speed case

When a vehicle enters the zone, the RFID Reader reads the corresponding speed and sends the signal. If the vehicle is at high speed, then it reduces the speed automatically. Here, by clicking RFID and typing the assigned value as **81**, the motor speed is reduced and LCD displays as "HOSPITAL ZONE". Thus, speed is controlled automatically.
All these status are updated in the IOT by sending signals serially by the pin UART for future references.

IX. CONCLUSION

Thus, in our system we have presented a reliable, efficient and smart way to monitor and control environment with low cost embedded system. This model can be further expanded to monitor the developing cities and industrial zones for pollution monitoring and accident control. This system can be easily implemented on commercial vehicles and has a large number of applications. To protect the public health from pollution, this model provides a good deal.

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BIOGRAPHY

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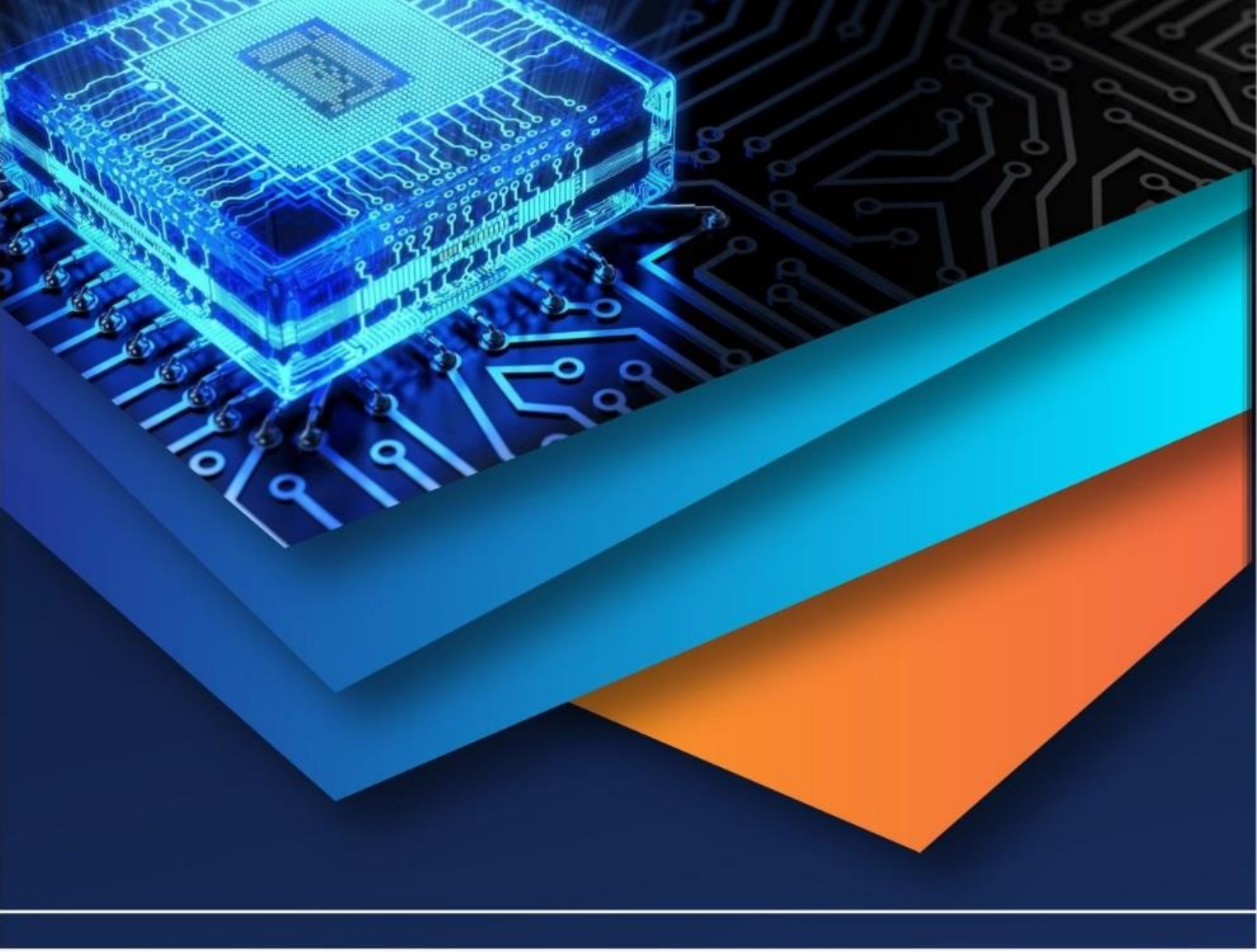

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