POWER GENERATION BY CONTROLLING AIR POLLUTION IN FACTORIES

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Abstract- This paper presents air pollution has becoming the major issue of modern megalopolis because of industrial emission. There are green laws in every country which not only prescribe limits for all kinds of factory pollution but also set rules and regulations which every factory must follow in its manufacturing process. Factories should develop long-term vision for pollution control. If they generate less pollution it means their products are green. Demand of green products is rising all over the world. It means factories can generate more sales and earn more profit. Most of the environmental laws related to industrial pollution prescribe punishments of fine and imprisonment to those industries which violate them. To overcome the pollution problem in factories, we are generating the power from the pollutant air by purifying the industrial gas using air filter bus. It is eco friendly. Continuous monitoring of pollutant air in and out in LCD using gas sensor. The entire operation is controlled by microcontroller

Key words*:* Ozone effect, Industrial air pollution, gas sensor, human health effect, air filer bus, sensor, mplab ide.

I. INTRODUCTION

With the fast development of the industrialization and urbanization process in the world, environmental pollution is now a common problem in most of the countries. Environmental pollution includes; air pollution, water pollution and soil pollution. Air pollution can be defined as the presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects. These pollutant substances usually result from vehicle emissions, Industrial emissions and volatile organic compounds. The health issues caused by air pollutants are difficulty in breathing, coughing and aggravation of existing respiratory and cardiac conditions. The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution, with 1.5 million of these deaths attributable to indoor air pollution. Based on the fact mentioned above, there is a need to focus on air pollution monitoring activities.

1.1 Sources

Factories pollute the air through fossil fuel emissions. These emissions include carbon dioxide, methane, and nitrous oxide. Combustion creates these toxic pollutants. While all of these are naturally-occurring substances, it is the high levels of emissions which are of concern. Industrial processes will also emit manmade emissions such as fluorine-containing gases such as hydro fluorocarbons.

1.2 Ozone effect

Chemical reactions create another air pollutant, ozone. Ozone forms with sunlight, nitrous oxide and volatile organic compounds in the air. Volatile organic compounds include fossil fuel emissions, chemical solvents, and by products of other industrial processes. When ozone stays close to the Earth surface, becomes harmful to human and environmental health. The Air Quality Index measures the levels of ozone and other common air pollutants.

1.3 Human Health Effects

Air pollution has severe human health effects. Ozone, for example, causes irritation to the respiratory system. It can aggravate existing conditions such as asthma and bronchitis. Carbon monoxide can adversely affect your cardiovascular and central nervous systems. Your body has some natural resistance and will attempt to fight off the effects of pollutants. Yet, some damage may be irreversible, according to a report by the National Aeronautics Space Administration.

1.4 Causes of Industrial Pollution

1. Lack of Policies to Control Pollution: Lack of effective policies and poor enforcement drive allowed many industries to bypass laws made by pollution Control board which resulted in mass scale pollution that affected lives of many people.
2. Unplanned Industrial Growth: In most industrial townships, unplanned growth took place wherein those companies flouted rules and norms and polluted the environment with both air and water pollution.
3. Use of Outdated Technologies: Most industries still rely on old technologies to produce products that generate large amount of waste. To avoid high cost and expenditure, many companies still make use of traditional technologies to produce high end products.

II. MODEL DESCRIPTION

In this paper, pollutant air which consists of pollutant gases is blown with the high speed by the blower in order to transmit the pollutant air inside the purification filter. The air filter bus is used to purify the polluted air and it sends out the purified air. This purified air blows inside the generator. Generator will produce the electricity of 12V from the purified air. Gas Sensor is used to determine the gas in and gas out. LCD will display the generated electricity and the gas in and gas out of the filter.

2.1 Power Supply unit

It involves Step down transformer to convert 230vAC to 12v AC. Bridge rectifier to convert 12V AC to 12V DC. Voltage regulator will convert 12V DC to 5vDC.

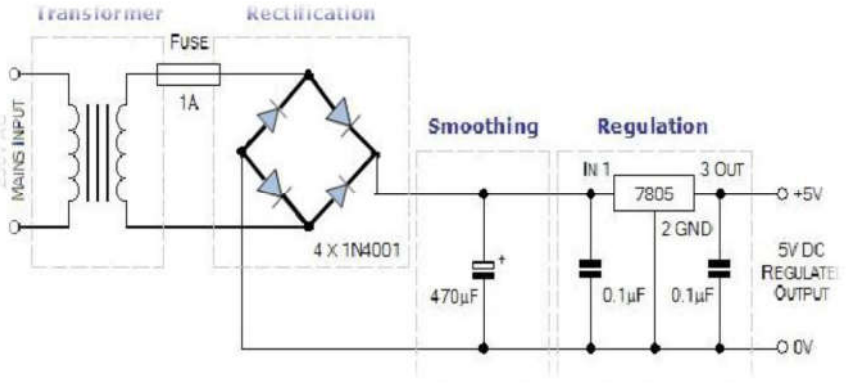

Figure 1: Power supply unit

Since the output after the diode bridge rectifiers is of pulsating nature, and for producing it as a pure DC, filtering is necessary. Filtering is normally performed with one or more capacitors attached across the load, as you can observe in the below figure wherein smoothing of wave is performed. This capacitor rating also depends on the output voltage.

The last stage of this regulated DC supply is a voltage regulator that maintains the output voltage to a constant level. Suppose the microcontroller works at 5V DC, but the output after the bridge rectifier is around 16V, so to reduce this voltage, and to maintain a constant level –no matter voltage changes in input side – a voltage regulator is necessary.

2.2. PIC 16F 877A Microcontroller

PIC16F877A have enough 33 I/O (Input/output) lines for current need. The master controller controls each functions of the system with a supporting device. It is also responsible for reception of commands from the host and taking necessary actions. This powerful (200 nanosecond instruction execution) yet easy-to program (only 35 single word instructions) CMOS (Complementary metal-oxide semiconductor) FLASH-based 8-bit microcontroller Packs The PIC16F877A features 256 bytes of EEPROM data memory, self-programming, 2 Comparators, 8 channels of 10-bit Analog-to- Digital (A/D) converter.

The synchronous serial port can be Configured as either 3-wire Serial Peripheral Interface (SPI) or the 2- wire Inter-Integrated Circuit bus and a Universal Asynchronous Receiver Transmitter (USART).It is used to sense the information from the gas sensor and stored it in memory.

2.3. Gas sensor

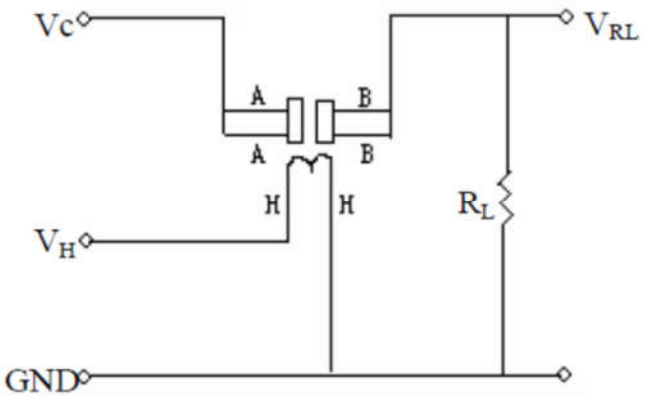

Figure 2: Basic test circuit of the sensor

It consists of flammable coil which gets heated up when it sense gas. It is connected to the Port A of the controller. The analog output from the gas sensor is converted into digital by the ADC in built with the controller producing 10 bit or 12 bit digital data. Sensitive material of MQ-7 gas sensor is SnO2, which with lower conductivity in clean air. It make detection by method of cycle high and low temperature, and detect CO when low temperature (heated by 1.5V). The sensor's conductivity is higher along with the gas concentration rising.

When high temperature (heated by 5.0V), it cleans the other gases adsorbed under low temperature. The sensor needs to be put 2 voltage, heater voltage (VH) and test voltage (VC). VH used to supply certified working temperature to the sensor, while VC used to detect voltage (VRL) on load resistance (RL) whom is in series with sensor. The sensor has light polarity, Vc need DC power. VC and VH could use same power circuit with precondition to assure performance of sensor.

In order to make the sensor with better performance, suitable RL value is needed: Power of Sensitivity body (Ps): Ps=Vc2×Rs/(Rs+RL)2 Resistance of sensor (Rs): Rs=(Vc/VRL-1)×RL 10

2.4 Generator

DC motor acts as a Generator. DC motor produces mechanical energy from electrical energy. By reversing the process of the dc motor, electrical energy will be converted into mechanical energy. The stator poles are supplied by dc excitation current, which produces a dc magnetic field. The rotor is supplied by dc current of 12V through the brushes, commutator and coils. The interaction of the magnetic field and rotor current generates a force that drives the motor. The magnetic field lines enter into the rotor from the north pole (N) and exit toward the south pole (S).

The poles generate a magnetic field that is perpendicular to the current carrying conductors. The interaction between the field and the current produces a Lorentz force; the force is perpendicular to both the magnetic field and conductor.

2.5. Blower details

Table 1: Blower details

Air Flow Capacity	2.3 m^3/min
No Load Speed	1300 rpm
Frequency	50 Hz
Power Consumption	500 W
Rated Voltage	220 V

It is used to blow the air into the purification filter.

2.6. Air filter Bus

Air in and out- 35.352 cc for a chimney in the kitchen with diameter 150 mm and height 300mm.In industries, depending upon the boiler, air filter are designed It use a pleated paper filter element in the form of a flat panel. This filter is usually placed inside a plastic box connected to the throttle body with ductwork. It use a cylindrical air filter, usually a few inches high and between (300mm) and (150 mm) in diameter. This is positioned above the carburetor or throttle body, usually in a metal or plastic container which may incorporate ducting to provide purified air to the environment with 35.35cc .The overall unit is called the air cleaner which purifies the pollutant gases. Filters containing an absorbent or catalyst such as charcoal (carbon) may also remove odors and gaseous pollutants

2.7. LCD

It is connected to the port B of the controller. It reads the data from the memory about gas in and gas out. The energy generated by the purified air and writes it in the display. 16 x 2 display is used. This section describes the operation modes of LCDs, and then describes how to program and interface an LCD to PIC Microcontroller.

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III. LCD INERFACING WIH PIC

3.1 liquid crystal display (LCD)

A liquid crystal display (LCD) is an electro-optical amplitude modulator realized as a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power. Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, and two polarizing filters, the axes of transmission of which are (in most of the cases) perpendicular to each other. With no liquid crystal between the polarizing filters, light passing through the first filter would be blocked by the second (crossed) polarizer. The surfaces of the electrodes that are in contact with the liquid crystal material are treated so as to align the liquid crystal molecules in a particular direction. This treatment typically consists of a thin polymer layer that is unidirectional rubbed using, for example, a cloth. The direction of the liquid crystal alignment is then defined by the direction of rubbing. Electrodes are made of a transparent conductor called Indium Tin Oxide (ITO). Before applying an electric field, the orientation of the liquid crystal molecules is determined by the alignment at the surfaces. In a twisted pneumatic device, the surface alignment directions at the two electrodes are perpendicular to each other. Half of the incident light is absorbed by the first polarizing filter, but otherwise the entire assembly is reasonably transparent. When a voltage is applied across the electrodes, a torque acts to align the liquid crystal molecules parallel to the electric field, distorting the helical structure (this is resisted by elastic forces since the molecules are constrained at the surfaces). The optical effect of a twisted pneumatic device in the voltage-on state is far less dependent on variations in the device thickness than that in the voltage off state. Because of this, these devices are usually operated between crossed polarizer's such that they appear bright with no voltage (the eye is much more sensitive to variations in the dark state than the bright state). These devices can also be operated between parallel polarizer's, in which case

the bright and dark states are reversed. The voltage-off dark state in this configuration appears blotchy, however, because of small variations of thickness across the device.

3.2. LCD OPERATION

In recent years the LCD is finding widespread use replacing LEDs (seven segment LEDs or other multi segment LEDs). LED must be refreshed by the CPU (or in some other way) to keep displaying the data. Ease of programming for characters and graphics.

3.3. Steps to interface LCD with PIC microcontroller

STEP 1: Identify: Determine what you want LCD are available in many flavors which are specified as follows 16x1 , 16x2 , 20x2 in the format AxB where A is the number of columns (chatters) and B is the number of Rows (lines) An LCD might also Is Backing lit.

STEP 2: Connect: Most of the LCD's follow the standard Hitachi Pin out which is simply.

STEP 3: Interface : Now connect pins RS ,RW ,E ,D0 - D7 to pins on the micro controller Let's suppose I connect Data bus on port A and the RS , RW , E on port B . (You can save pins by using LCD in Nibble Mode (4 data pins) and permanently grounding the RW line (always in write mode).

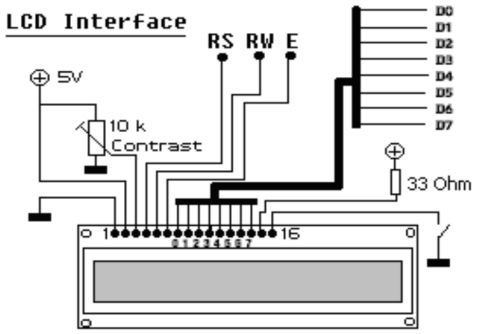

Figure.3. LCD interfacing

Now we'll see how to go from simple switching it on to graphics on the LCD. An Intelligent LCD Need only a few Commands and data to function Command Set for the LCD.

Table2: LCD pin description

Pin No	Name	Function	USE
1	Vss	Ground	
2	Vdd	+ve Supply	5v Volts Regulated DC
3	Vee	Contrast	This is used to set the contrast1
4	RS	Register Set	Register select signal "0":Instruction register (when writing) Busy flag & address counter (When reading) "1":Data register (when writing & reading)
5	R/W	Read / Write	Read/write select signal "0" for writing , "1" for reading
6	E	Enable	Operation (data read/write) enable signal
7	D0	Data Bit 0	Data transmission between 0 to 7 bit
8	D1	Data Bit 1	
9	D2	Data Bit 2	
10	D3	Data Bit 3	
11	D4	Data Bit 4	
12	D5	Data Bit 5	
13	D6	Data Bit 6	
14	D7	Data Bit 7	
15	A	for Back light	Positive supply for back light if available
16	K	Power supply Back light (0V)	

IV.SOFWARE DESCRIPION

4.1MPLAB IDE

Microchip has a large suite of software and hardware development tools integrated within one software package called MPLAB Integrated Development Environment (IDE). MPLAB IDE is a free, integrated toolset for the development of embedded applications on Microchip's PIC and dsPIC microcontrollers. It is called an Integrated Development Environment, or IDE, because it provides a single integrated environment to develop code for embedded microcontrollers. MPLAB IDE runs as a 32-bit application on MS Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB IDE also serves as a single, unified Graphical user interface for additional Microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB IDE has the same user interface for all tools.

4.2. Key features

The MPLAB IDE provides the ability to:

- Create and edit source code using the built-in editor.
- Assemble, compile and link source code.
- Debug the executable logic by watching program flow with the built in simulator or in real time with in-circuit emulators or in-circuit debuggers.
- Make timing measurements with the simulator or emulator.
- View variables in Watch windows.
- Program firmware into devices with device programmers

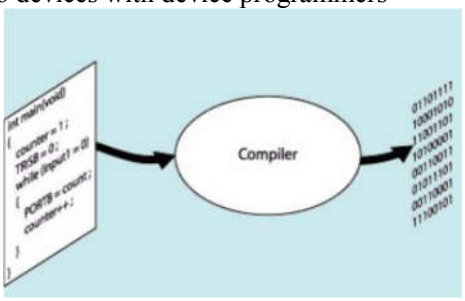

Figure 4.mplab functional diagram

4.3 Language tools

Choose MPLAB C Compilers, the highly optimized compilers for the PIC18 series microcontrollers, high performance PIC24 MCUs, dsPIC digital signal controllers and PIC32MX MCUs. Or, use one of the many products from third party language tools vendors. Most integrate into MPLAB IDE to function transparently from the MPLAB project manager, editor and debugger Microchip's MPLAB C compilers are full-featured, ANSI compliant high performance tools tightly integrated with MPLAB IDE. Source level debugging allows single stepping through C source code and inspecting variables and structures at critical points in the code.

4.4 Microchip MPLAB C Compliers

1. MPLAB C Compiler for PIC18 MCUs (C compiler for PIC18)
2. MPLAB C Compiler for PIC24 MCUs (C compiler for PIC24)
3. MPLAB C Compiler for dsPIC DSCs (C compiler for dsPIC)
4. MPLAB C for PIC32 MCUs (C compiler for PIC32

4.5 Flow code

Flow code is one of the world's most advanced graphical programming languages for microcontrollers. The great advantage of Flow code is that it allows those with little to no programming experience to create complex electronic systems in minutes. Flow code supports code generation for the PIC (Flow code for PIC12, PIC16, and PIC18 series), PIC24 and dsPIC series of microcontrollers.

4.6 PROTEUS DESIGN SUITE

The Proteus Design Suite is an Electronic Design Automation (EDA) tool including schematic capture, simulation and PCB Layout modules. It is developed in Yorkshire, England by Lab center Electronics Ltd with offices in North America and several overseas sales channels. The software runs on the Windows operating system

4.7 Product modules

The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design. It can be purchased in many configurations,
Depending on the size of designs being produced and the requirements for microcontroller simulation. All PCB Design products include an auto router and basic mixed mode SPICE simulation capabilities.

4.8 Schematic Capture

Schematic capture in the Proteus Design Suite is used for both the simulation of designs and as the design phase of a PCB layout project. It is therefore a core component and is included with all product configurations.

4.9 MICRO CONTROLLER SIMULATION

The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co simulated along with any analog and digital electronics connected to it. This enables it's used in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design. It also finds use in the general hobbyist community and, since no hardware is required, is convenient to use as training or teaching tool. Support is available for co-simulation of:

- Microchip Technologies PIC10, PIC12, PIC16, PIC18, PIC24, dsPIC33 Microcontrollers.
- Atmel AVR and Adriano, 8051 and ARM Cortex-M3 Microcontrollers
- NXP 8051, ARM7, ARM Cortex-M0 and ARM Cortex-M3 Microcontrollers.
- Texas Instruments MSP430, PICCOLO DSP and ARM Cortex-M3
- Microcontrollers
- Parallax Basic Stamp, Free scale HC11, 8086 Microcontrollers.

4.10 PCB Design

The PCB Layout module is automatically given connectivity information in the form of a net list from the schematic capture module. It applies this Information, together with the user specified design rules and various design automation tools, to assist with error free board design. Design Rule Checking Does not include high speed design constraints. PCB's of up to 16 copper layers can be produced with design size limited by product configuration.

4.11 Verification

The 3D Viewer module allows the board under development to be viewed in 3D together with a semi-transparent height plane that represents the boards' enclosure. STEP output can then be used to transfer to mechanical CAD software such as Solid works or Autodesk for accurate mounting and positioning of the board.

V. RESULTS

Thus the design and development of power generations by controlling a pollutant air in a system was successfully done. Mainly deals with the development of air purification system in industries to minimizing the pollution and improving an environmental enhance. The main advantage is to generate a power without any fuel cost and we also reducing the greenhouse effect.

Figure-5 output unit and controller kit

Figure-6 LCD Display

V. Conclusion

All manufacturing industries in our country is based on taking samples one or few times a day, which means that there is no information about time distribution of polluted materials intensity during day till now, this are a theoretical idea to install a windmill in an industry. But we may have a great success from this assumption. Though the output power is not quite enough in quantity because of some factor, but step by step improvement can make a dynamic change in energy resources. Our future work could be focused on how could be the velocity be increased as we see that the power production is largely depend upon the velocity of air

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