Purification Of Air In The Environment Using Filtering Process With Electric Power Generation

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Abstract- It is known that our environment is being polluted by many things and our society is majorly polluted by air pollution. So the controlling of CO_2 content and maintaining of air quality is very important for the well being of humans. This method provides a way for reducing of CO_2 content, removing the fine dust particles and in addition to that generation of power using filtering process. The air in the environment is sucked inside the cylindrical part using inlet blowers. The environment air is initially fed to the Electrostatic Precipitator (ESP), where the dust and fine particles in the air is filtered using the force of an electrostatic attraction. Then, the filtered air is fed to the sodium hydroxide solution where the CO_2 contained in the air separated into carbon and oxygen. During the separation process, the heat is generated and it is converted into electric power using peltier plates in the solution.

Keywords – Carbon dioxide, Electrostatic precipitator, Sodium Hydroxide, Electric power generation.

I. INTRODUCTION

Air pollution is one of the key problems of major urban areas in developing and industrial countries, especially where air quality measurements are not available or minimally implemented or enforced. It is estimated that around 91% of the world's population lives in places where air quality exceeds the limit specified by the World Health Organization (WHO) guidelines and around 4.2 million deaths every year can be directly attributed to exposure to ambient (outdoor) air pollution. Air pollution contributes to climate changes and sometimes, it may lead to human's death. Air is polluted mainly by increase of vehicles, burning of fossil fuels in power plants, exhaust from factories and industries. Because of this exhaust, green house gases increases and it can affect humans harmfully and it is very important to control it. The air in the environment contains more amount of dust, smoke and fine particles. As a human being it is important to get clean and pure air for having a healthy life. The aim of this paper is to provide clean and pure air to the society by using our idea. All the people in the India know about the environmental condition of the Delhi city and how badly it is affected from air pollution. So, the main objective of this paper is to reduce the air pollution in the highly affected cities and as well as generation of electric power during the purification process for utilizing street lights and LCD's.

II. PROPOSED SYSTEM

The proposed system is used to purify the air in the environment using filtering process and to provide a clean air. The system mainly consists of three sections namely Filtering section, Separating section and Generating section. The system mainly concentrates on filtering the air, increasing the oxygen content in air and in addition to that generating power from the absorbed CO_2. The Block diagram of the proposed system is shown in the Figure-1. The filtering section which contains input blowers which suck in air to the system. The amount of CO_2 content in air is measured by the CO_2 sensor. This air is fed to the electrostatic precipitator and it filters the fine particles like dust, smoke, soot and ash in the air. Then the filtered air is fed into the sodium hydroxide (NaOH) solution. The CO_2 in

the air is reacts with sodium hydroxide solution and it is separated into carbon and oxygen [1, 2]. During the separation process, heat is produced and that the heat is absorbed by using "peltier plates" in the solution and it is converted into electric power.

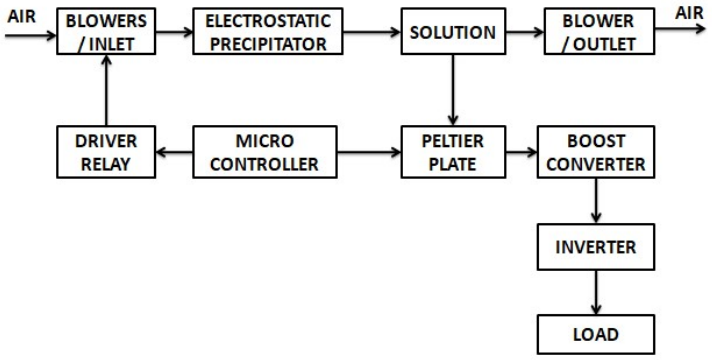

Fig.1 Block Diagram of proposed system

III. FUNCTIONAL ELEMENTS OF THE SYSTEM

3.1 Electrostatic precipitator

An electrostatic precipitator (ESP) is defined as a filtration device that's wont to remove fine particles like smoke and fine dust from the flowing gas. It is the commonly used device for pollution control. It consists of two sets of electrodes: positive and negative. The negative electrodes are within the sort of a wire mesh and therefore the positive electrodes are within the sort of plates. These electrodes are vertically placed and are alternate to every other. The negative terminal of high voltage DC source is employed to attach the negative electrodes and therefore the positive terminal of the DC source is employed to attach the positive plates. To ionize the medium between the negative and therefore the positive electrode, a particular distance is maintained between the positive, negative electrode and therefore the DC source leading to a high voltage gradient. The medium that is used between the two electrodes is air.

3.2. Gas sensor

Gas sensor may be a device which detects the presence or concentration of gases within the atmosphere. Based on the concentration of the gas the sensor produces a corresponding electric potential by changing the resistance of the fabric inside the sensor, which may be measured as output voltage. Based on this voltage value the sort and concentration of the gas are often estimated. The type of gas the sensor could detect depends on the sensing material present inside the sensor.

3.3 Driver relay

A relay can be defined as a switch. Switches are generally wont to close or open the circuit manually. Relay is additionally a switch that connects or disconnects two circuits. But rather than manual operation a relay is applied with electrical signal, which successively connects or disconnects another circuit. Relays are simple switches which are operated both electrically and mechanically. Relays contain an electromagnet and also a group of contacts. The switching mechanism is administered with the assistance of the electromagnet.

3.4 Peltier plate

Thermoelectric coolers operate according to the Peltier effect. The effect creates a temperature difference by transferring heat between two electrical junctions. A voltage is applied across joined conductors to make an electrical current. When the present flows through the junctions of the two conductors, heat is removed at one junction and cooling occurs. Heat is deposited at the other junction.

3.5 Boost converter

A boost converter (step-up converter) may be a DC-to-DC power converter that steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a category of switched-mode power supply (SMPS) containing a minimum of two semiconductors (a diode and a transistor) and a minimum of one energy storage element: a capacitor, inductor, or the two in combination. The key principle that drives the boost converter is that the tendency of an inductor to resist changes in current by creating and destroying a magnetic flux. In a boost converter, the output voltage is usually above the input voltage.

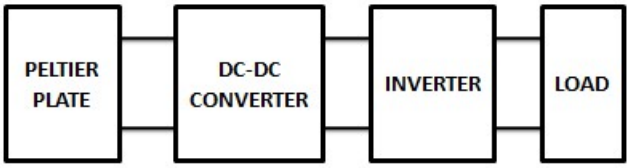

Fig.2 Power generation system

(i) When the switch is closed, current flows through the inductor within the clockwise direction and therefore the inductor stores some energy by generating a magnetic flux. Polarity of the left side of the inductor is positive.

(ii) When the switch is opened, current will be reduced as the impedance is higher. The magnetic flux previously created is going to be destroyed to take care of the present towards the load. Thus the polarity are going to be reversed (meaning the left side of the inductor will become negative). As a result, two sources are going to be serial causing a better voltage to charge the capacitor through the diode.

3.6 pH sensor

A pH meter takes advantage of this and works sort of a voltmeter: it measures the voltage (electrical potential) produced by the answer whose acidity we're curious about , compares it with the voltage of a known solution, and uses the difference in voltage (the "potential difference") between them to deduce the difference in pH.

3.7 Atmega 328

The ATmega328 may be a single-chip microcontroller created by Atmel within the mega AVR family (later Microchip Technology acquired Atmel in 2016) and it is shown in the Figure-2. It has a modified Harvard architecture 8-bit RISC processor core. It has an EEPROM memory of 1KB and its SRAM memory is of 2KB.

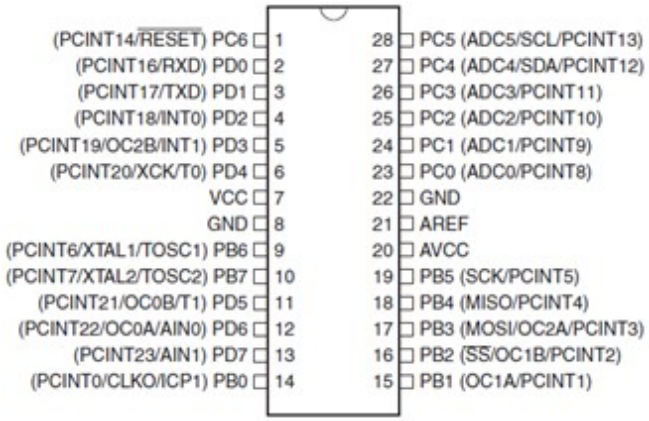

Fig.3 Pin diagram of Atmega328

The Atmega328 has 28 pins. It has 14 digital I/O pins, of which 6 are often used as PWM outputs and 6 analog input pins. These I/O pins account for 20 of the pins. This means they will function as an input to the circuit or as output. Whether they are input or output is about within the software. 14 of the pins are digital pins, of which 6 can function to offer PWM output. 6 of the pins are for analog input/output. 2 of the pins are for the quartz oscillator. This is to supply a clock pulse for the Atmega chip. A clock pulse is required for synchronization in order that communication can occur in synchrony between the Atmega chip and a tool that it's connected to. The chip needs power so 2 of the pins, Vcc and GND, provide it power in order that it can operate. The Atmega328 may be a low-power chip, so it only needs between 1.8-5.5V of power to work.

3.8 Inverter

A power inverter, or inverter, is a power electronic device or circuitry that changes direct current (DC) to alternating current (AC) while at the same time regulating the voltage, current and frequency of the signal. The input voltage, output voltage and frequency, and overall power handling depend upon the planning of the precise device or circuitry. The inverter doesn't produce any power; the facility is provided by the DC source.

3.9 LCD

An LCD is an electronic display module which uses liquid to supply a clear image. It is combination of two states of matter, the solid and therefore the liquid. The 16×2 LCD display may be a very basic module commonly utilized in DIYs and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed during a 5×7 pixel matrix.

3.10 Sodium hydroxide

Sodium hydroxide, also referred to as lye and sodium hydroxide, is a compound with the formula NaOH. It is a white crystalline odourless solid that absorbs moisture from the air. It is a manufactured substance. When dissolved in water or neutralized with acid it liberates substantial heat, which can be sufficient to ignite combustible materials. Sodium hydroxide is very corrosive. It is generally used as a solid or a 50% solution.

IV.CONCLUSION

The impurity in the air can be reduced by many methods like gas to liquids, hydrogen fuel additives, autonomous vehicles and electric bikes and the impurity in the air can be purified by "smog free tower" which is the latest technology introduced in Beijing, china [3]. It turns the fine carbon particles that the tower collects into tiny "gem stones" [4]. On comparing with our proposed system to the existing systems, our project removes (filters) the air from the fine particles like dust, smoke, soot and ash. Then the filtered air contains co2 and it is separated into oxygen and carbon by the use of sodium hydroxide solution. The main novelty of our proposed system is to generate power from the carbon dioxide present in the air by the separation process. From our project purification of the environmental air is done and at the same time, power is generated.

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