Monitoring and Controlling of Smolder Exhaustion Using Electrostatic Precipitator

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Abstract: High-voltage pulse power supply technology is a new effective improvement in electric dust precipitation, based on ARM7. Nowadays so many people are using vehicles, due to that carbon range in air is increased. Some factories also spread the carbon nitrate in the air. This is very dangerous, it affects the human being, especially causes the heart diseases. This project proposes how to monitor and control the waste gas exhausted by power plants, and vehicles, using Electrostatic precipitator. The Environmental Protection Department has declared a level of waste gas exhaust per year. If the large factory’s chimney polluted waste gas emitted into the sky secretly, in this system can detect the crossing level, and then send special information to Environmental protection department, through Ethernet communication. It also controls the vehicles smoke exhaustion.

Keywords- High-voltage Pulse Power Supply; CO₂ sensor; ARM7; PWM;

I. INTRODUCTION

The environment is a global problem, and dust in industrial production of human environmental pollution in the largest and direct, is a worldwide problem. The industries of thermal power, metallurgy, cement, and vehicles else enterprises discharge smokes and dusts everyday, which is a major source of air pollution. In 2004, the environmental gas emission standards for dust in the atmosphere was improved from 150mg/m³ to 50mg/m³. And the newly issued national environmental protection standard of dust was implemented in 2010. The dust emission standards of various industries increased to 30mg/m³.

Currently, people's health has been seriously hurt by the air pollution in our country. Research shows the major and determinant factor which causes the chronic respiratory disease obstacle is the atmospheric pollution unfortunately.

The atmospheric pollution causes huge economic losses, and then restricts the economic development largely. According to the statistics, 1/3 of the atmospheric pollution is emitted from Vehicles, factory chimneys in our state, however, due to the factory chimneys have characteristics such as widespread distribution range and high altitude, the environment protection departments have some difficulties in monitoring the industry chimney, CO₂ gas sensor detects the amount of carbon present in the air, which causes that the large factory chimneys drain the polluted waste gas into the sky secretly and arbitrarily, Ethernet communication used to send a special information to the environmental protection department, and results in deterioration of the environment.

II. IMPLEMENTATION OF HARDWARE

The overview of this concept to detect and control the amount of carbon (CO₂) present in the exhaust smoke for vehicles (silencer) and power plant chimneys. The electrostatic precipitator system consists of PC, high voltage pulse power device controller and the electrical dust collector.

An ESP, or electrostatic air cleaner is a particulate collection device that removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge.

The electrostatic precipitator is widely used for the high efficiency, low energy consumption, and wide applicability, for various systems.

Fig 1. High voltage pulse power supply device
Transformer is used in step down mode of operation in the sense it provides an output, which is reduced in form compared to input. Primary winding is fed with a supply of 230v, 50Hz a.c, which appears as an voltage approximately 15v across secondary winding. This voltage is fed into the rectifier circuit for the purpose of rectification i.e., converting a.c. input to D.C. output. The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

According to the above-mentioned indicators, a controller with a core of ARM7 LPC2148 microcontrollers is based on a 16-bit/32-bit, Due to their tiny size and low power consumption.

The ARM7 is a low-power; general purpose 32-bit RISC microprocessor macro cell for use in application or customer-specific integrated circuits (ASICs or CSICs). Its simple, elegant and fully static design is particularly suitable for cost and power-sensitive applications. The ARM7’s small die size makes it ideal for integrating into a larger custom chip that could also contain RAM, ROM, logic, DSP and other cells.

Pulse width modulation (PWM) is a powerful digitally encoding technique for analog signal. Each PWM generator modulation contains one timer (16- bit down or up/down counter), two PWM comparators, a PWM signal generator, a dead-band generator, and an interrupt/ADC-trigger selector. Each PWM generator block produces two PWM signals which can either be independent signals (other than being based on the same timer and therefore having the same frequency) or a single pair of complementary signals with dead-band delays inserted. The output of the PWM generation blocks are managed by the output control block before being passed to the device pins.

Pulse-width modulation (PWM) of a signal or power source involves the modulation of its duty cycle, to either convey information over a communications channel or control the amount of power sent to a load. High frequency PWM power control systems are easily realizable with semiconductor switches. The discrete on/off states of the modulation are used to control the state of the switch (es) which correspondingly control the voltage across or current through the load.

Air pollution sensor to measure the pollution mixed in the Air. It is the special type of sensor and act as transducer. So it measure the pollution in the air and depends upon the pollution it generate the cottage pulse these pulse are in the milli voltage level. So it given to

Fig 2. Block diagram of controller system structure

III. THE DESIGN OF ARM PROCESSOR

IV. IMPLIMENTATION OF PULSE GENERATOR

Pulse width modulation (PWM) of a signal or power source involves the modulation of its duty cycle, to either convey information over a communications channel or control the amount of power sent to a load. High frequency PWM power control systems are easily realizable with semiconductor switches. The discrete on/off states of the modulation are used to control the state of the switch (es) which correspondingly control the voltage across or current through the load.

V. DESIGN OF SENSOR MEASUREEMENT CIRCUIT
amplifier unit. The Amplifier unit consists of operational amplifier. The incoming small voltage pulses are amplified into certain voltage level then the amplified voltage signals are given to ADC.

ADC is nothing but analog to digital converter. It is the 8-bit converter. So it signal and corresponding digital signals are fed to the micro controller. Here the micro controller may be Atmel89C51 or PIC micro controller both are flash type reprogrammable micro controller in which we have already programmed so it receive the signals from ADC and corresponding pollution range will be displayed in the LCD Display.

Resistance value of MQ-135 is difference to various kinds and various concentration gases. So, when using this component, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 100ppm NH3 or 50ppm Alcohol concentration in air and use value of Load resistance that( RL) about 20 KΩ(10KΩ to 47 KΩ).

<table>
<thead>
<tr>
<th>Parts</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gas sensing layer</td>
<td>SnO₂</td>
</tr>
<tr>
<td>2 Electrode</td>
<td>Au</td>
</tr>
<tr>
<td>3 Electrode line</td>
<td>Pt</td>
</tr>
<tr>
<td>4 Heater coil</td>
<td>Ni-Cr alloy</td>
</tr>
<tr>
<td>5 Tubular ceramic</td>
<td>Al₂O₃</td>
</tr>
<tr>
<td>6 Anti-explosion network</td>
<td>Stainless steel gauze (SUS316 100-mesh)</td>
</tr>
<tr>
<td>7 Clamp ring</td>
<td>Copper plating Ni</td>
</tr>
<tr>
<td>8 Resin base</td>
<td>Bakelite</td>
</tr>
<tr>
<td>9 Tube Pin</td>
<td>Copper plating Ni</td>
</tr>
</tbody>
</table>

The CO₂ Gas Sensor measures gaseous carbon dioxide levels in the range of 0 to 10,000 ppm (low range setting) or 0 to 100,000 ppm (high range setting) by monitoring the amount of infrared radiation absorbed by carbon dioxide molecules.

VI. ETHERNET CONTROLLER

LM3S8962 integrates an Ethernet controller. The Ethernet Controller consists of a fully integrated Media Access Controller (MAC) and a network physical (PHY) interface. Therefore, compared with the common design of Ethernet node based on MCU or ARM, an external PHY chips such as the DM9161, RTL8019, It only need an appropriate network adapter and an RJ45 interface. The Ethernet controller circuit was shown in Figure.3.7 RS485 interface circuit LM3S8962 contains two RS485 modules.

RS485 network is bus network of one master and multi slaves. When several RS485 devices worked together, only one device output data, and other devices to receive data at the same time. SP3485EN is a RS485 transceiver based on the UART interface. The device control the receipt enable and transmission enable by two control pins named as PIN2 and PIN3. The pin PF1 controls the transmission and reception of SP3485EN, transmit data with UART1. In process of transmission, the PF1 is set to low, and then the data can be transmitted, when the transmission is completed, PF1 pin return to high to receive data.
RS485 interface circuit

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VII. SOFTWARE IMPLIMENTATION

µC/OS-II is a certified, open source embedded real-time multitasking operating system, which includes real-time kernel, task management, time management, synchronization inter-task communication and memory management, and other functions. Each task can work independently, it is easy to implement timely and correctly which make the design of real-time applications and extension easier and simplified. Most of the codes of it uses C language, contains a small portion of assembly codes. It has been successfully transplanted to DSP, 16/32 bit MCU. The transplants of _C/OS-II include the modification of programs concerned with the processor and addition of applications The system chosen of LM3S8962 ARM and the LM link compilers conform to the operating system of the transplant conditions. The host establish the cross-development and debugging environment on target board through the JTAG interface. The main task of the whole control system including: reading and writing PWM data and change the parameter to adjust the waveforms. After the completion of the codes for above tasks, then preparation the interrupt service routine, and start the operating system, the applications is running. µC/OS-II can manage up to 64 tasks. The four highest priority tasks and the four lowest priority tasks are reserved for its own use. This leaves 56 tasks for applications. The lower the value of the priority, the higher the priority of the task. (Something on the lines of Rate Monotonic Scheduling). The task priority number also serves as the task identifier.

VIII. CONCLUSION

Most of the pollution is caused by the vehicles and industries due to CO2 emission. The controlling and monitoring of CO2 emission gives significant change in air pollution. High voltage pulse power supply electric dust precipitation technology is a new type of traditional environmental technology. By considering all these factors this project deals with monitoring and controlling of smoke exhaust using Electrostatic precipitator. The monitors the CO2 emission in the chimneys and overall this system controls the CO2 emission into atmosphere and hence reducing green house effect and other global warming. Thus saving humans heart diseases.

REFERENCES