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Automobile Cabin Air Filter

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ABSTRACT

Air filter system plays a significant role in getting good quality air in automobile Cabin. It improves human comfort in terms of efficiency and also reduces air pollution. The work of an air filter is to filter the dirt particles from the intake air, supply cleaner air to the cabin and recirculate the filtered air. Optimum utilization of filters can significantly reduce the cost of filter replacements frequently and keep the filter in use for a longer time.

This paper will be discussed health and Cabin air purifiers that deliver best-in-class air purification performance for cars of all sizes, with a compact. It combines electrostatic and mechanical filtration to deliver low noise, 360° airflow, and high CADR. It provides more than 95% filtration efficiency against PM 2.5, pollen, dust, yellow dust, and industrial emissions.

Keywords: Automobile Cabin Air Filter, Mobile Operated Filter, IOT based Air Filter.

I. INTRODUCTION

Early in the history of the vehicle, oil was affordable and appeared to be boundless. Additionally, no one everconsidered the fundamental issues of today, such as greenhouse gases or global warming. But while people's awareness of these issues has grown in recent years, oil prices have also climbed significantly during theprevious several decades. Consumers are led to health safety by taking into account all of these factors of the health and ongoing improvements in government rules for lowering pollution in the automobile sector. This improves the automobile sector in health safety.

The air that is supplied to the air induction system is drawn into the case through the filter and then transferred to the desired area of the vehicle's cabin.

It is important that the air that passes through the filter is evenly spread.The cost of changing filters more frequently can be reduced by using filter elements to their maximum potential, extending the life of the filter. The design of the air induction system is important in determining the air flow's quality. Human performance was impacted by the diffuser's design and the flow around it when air was drawn in. This is due to various air-gathering characteristics.

Pressure losses in the air induction system are decreased as a result of reduced air pollution and consumption. High airflows and minimal pressure losses are required for the ideal air induction system. A full understanding of flows and pressure drop throughout the system is necessary for air induction system optimization. Numerous tools are used to predict the flow as well as experiments that are

conducted in the flow. The best option for analyzing the flow of a whole air induction system is thought to be an air cabin filter. Here, we are concentrating on the evaluation of air filter performance standards for its best application in the automotive industry

II. METHODOLOGY

The objective of the proposed cabin Air Filter is to improve the overall performance of a simple filter. The schematic representation with block structure shown in figure 1 the parts of the developed system such as ESP8266 (WiFiModule and Arduino uno), MQ135 (air Sensor), DHT 11 (Humidity and Temperature Sensor), LCD display, I2C Module(Serial Interface Mode), Relay Module, Filter (Circular in Shape), 5V Regulator, Power 12V Supply Unit.

You can remove in-car air pollution with a cabin air purifier, ensuring that you and your family always breathe clean, healthy air. Cabin purifies the air inside your car in just six minutes, and because fresh air keeps you refreshed and alert, Cabin also helps you drive more safely.

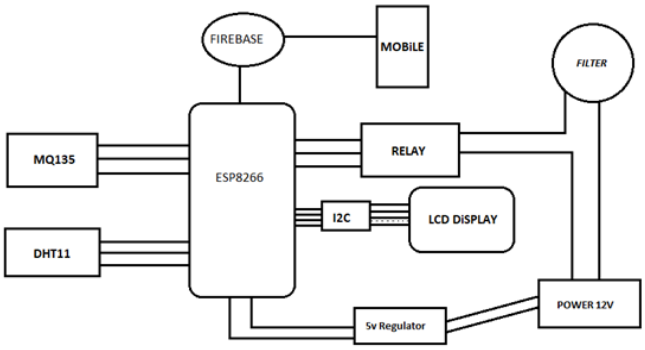

Figure 1. Block Structure

Truck drivers typically work long hours in filthy locations such as mines. Driver health and awareness while driving are critical for avoiding workplace accidents. Inside the cabin, air quality might degrade, which can contribute to driver tiredness. To develop systems that can monitor and enhance the air quality level within the cabin while also alerting the driver to essential health features such as oxygen level, temperature, humidity, and pollution levels in the air for human requirements.

Table 1. Specification of the hardware components

Components	Specification
Relay switch	Contact rating: 10A,240VAC/24VDC Max. carrying current: 14A Max. switching power: 2400VA, 240W Initial resistance: Max. 100mΩ at6VDC, 1A
MQ 135Gas Sensor	Sensing resistance: 1MΩ – 8MΩ Operating voltage: 5V ± 0.1
Display	Type: HD44780 Operating voltage: 4.7V – 5.3V Display: 2 × 16 characters Pixels: 5 × 8-pixel box Operating bits: 8-bit and 4-bit mode
Arduino UNO	Microcontroller: ATmega328P Operating voltage: 5V Flash memory 32KB Clock speed 16MHz Analog I/O pins: 6 Digital I/O pins:14
DHT 11 Humidity Temperature sensor	Operating voltage: 3.3V-5V DC Measurement range 20-95%RH, 0-50°C Operating bits: 8bit (temperature), 8bit (humidity) Compatible interfaces: 2.54 3-pin interface and 4-pin grove interface
I2C Serial Interface Adapter Module	Operating voltage: 5V DC I2C control using PCF8574 Operating interfaces: 8 modules on a single I2C bus I2C Address: 0X20~0X27
5V regulator	Min. Input voltage: 7V Max. Input voltage: 35V Current rating $I_{c=}$ 1A Max. Output voltage: $V_{Max=5.2V}$ Min. Output voltage: $V_{Min=4.8V}$

NodeMCU ESP8266 Wifi Module	Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106 Operating Voltage: 3.3V Input Voltage: 7-12V Flash Memory: 4MB Clock Speed: 80MHz Small sized module to fit smartly your IoT Projects

III. RESULTS AND DISCUSSION

The purpose of smart air cabin filters on basis of the air quality of specified areas they retreated by removing PM2.5, dust, pollen, yellow dust, and industrial emission. Also get real-time data through internet capability in this filter module, for better work performance in driving for long distances.

This filter is works on Humans who generally feel comfortable between temperatures of 22 °C to 27 °C and relative humidity of 40% to 60%. In this application, air at 35 °C and 60% relative humidity will be conditioned into the human comfort zone, with the thermodynamic process plotted on a psychrometric chart automated through an internet-based setup is implanted on that.

The filter properties and the distribution of the particles are generally homogeneous and independent of the surrounding of inside the model of the filter and its level of usage. The relatively high concentration of PM trapped in these filters poses the high air quality inside a car.

IV. CONCLUSION

From the review of some articles, different finding are concluded as mention below.

- Air filter is the integral part of ventilation system that filtration of air for better quality of air in automobile cabin and other reference places thatis required.
- Air intake through the filter maintain the pressure of a cabin.
- Parameters that affect the air filter performance areas:
  - Type of air filter is in use.
  - Requirements of air quality
  - Performance analysis of filter
  - Size of filter
  - Material of the filter element
- Due to larger particle's penetration into the filter,the filtration efficiencies for uniform flowdistribution is better than non-uniform flowdistribution. For small particles the filtrationefficiency decreases for the uniform flowDistribution.

V. REFERENCES

[1]. G. A. Brown et al., “Pressure drop and flow characteristics for clean heavy-duty air cleaner,” SAE Tech. Pap., 1987, doi: 10.4271/872219.

[2]. X. Wang, K. Kim, C. Lee, and J. Kim, “Prediction of air filter efficiency and pressure drop in air filtration media using a stochastic simulation,” Fibers Polym., vol. 9,no. 1, pp. 34 – 38, 2008, doi: 10.1007/s12221-008-0006-4.

[3]. H. B. R. Gan, N. Z. A. Bakar, N. F. S. Dawood, and M. A. Rosli, “Design improvements of an automotive air intake system,” AIP Conf. Proc., vol. 2233, no. May 2020, doi: 10.1063/5.0001440

[4]. S. Kaur and H. E. R. Malik, "Design Optimization of Automotive Air Filter Housing for Minimum Pressure Drop” International Journal of Engineering Development, vol. 5, no. 4, pp. 1167-1170,2017.

[5]. N. Nassif, “The impact of air filter pressuredrop on the performance of typical air-conditioning systems,” Build. Simul., vol. 5, no. 4, pp. 345 – 350, 2012, doi:10.1007/s12273-012-00.

[6]. J. Chaudhuri, A. Baukelmann, K. Boettcher, and P.Ehrhard, “Pressure drop in fibrousfilters,” Eur. J. Mech. B/Fluids, vol. 76, pp.115 – 121, 2019, doi:10.1016/jeuromechflu.2019.01.013.

[7]. S. Anand, F. M. Jadbabaei, and R. L. Dougherty, "Comparison of air filtration efficiency measurements for pleated and flat sheet filters,"SAE Tech. Pap., no. 412, 1997, doi: 10.4271/970671

[8]. M. R. Chopade, A. P. Valavade, S. H.Barhatte, M. Engineering, and M. I. T. College, "Performance enhancement of air filter by design optimization "International Journal of Advanced EngineeringTechnology, vol. III, Issue I, Jan-March 2017/68-70.

[9]. IS. Engineering, "Analysis of pleated air filters using computational fluid dynamics," 1997.

[10].R. Manikantan and E. J. Gunasekaran, "Modeling and Analysing of Air Filter in Air Intake System in Automobile Engine," vol.2013, 2013, doi: 10.1155/2013/654396.

[11].Githubhttps://github.com/esp8266/Arduino

[12].Arduino IDE https://www.arduino.cc/en/software