International Journal of
Advanced Robotics and Automation Technology
Volume 1, Issue 1, 2023
Jamuary-June
DOI (Journal): 10.37591/IJARAT
https://journals.stmjournals.com/ijarat
STM JOURNALS
Review IJARAT

Design and Development of an Automatic Blower System for Improved Efficiency in Industrial Applications

Shashank Gupta*

Abstract

The design and development of an automatic blower system to improve productivity in manufacturing processes are presented in this research article. The suggested system employs advanced control algorithms and sensors to improve the blower's function while minimizing energy usage. The goal of the research is to automate the blower system's operation by incorporating intelligent features, which will decrease the need for human intervention and increase overall efficiency. Experimental results reveal considerable gains in energy efficiency and performance compared to typical manual control approaches. The discoveries of this research contribute to the advancement of automated systems in manufacturing environments, boosting ecologically friendly and advantageous functioning. Scientific advancements have accelerated the technique of machinery advancement to a new level, enabling fully automated manufacturing equipment to enter the market and eventually phase out manual labor. Automation attackers are one of several linked sectors that have grown over the past few years because of the development of industrial automation. The creation of attackers as a new piece of machinery to operate automated production lines can significantly raise the level of automation of manufacturing businesses and increase worker productivity.

Keywords: Automatic blower system, efficiency, industrial applications, control algorithms, energy consumption

INTRODUCTION

Blowers are frequently used in manufacturing processes that require air circulation, temperature, and movement of air. These blowers are essential for preserving ideal operational conditions, guaranteeing the integrity of the product, and establishing a secure workplace. Nevertheless, manual operation in traditional blower systems frequently results in inconsistencies, subpar performance, and wasteful energy use. Due to rising energy prices, issues related to the environment, and the push for sustainable practices, the demand for increased efficiency in industrial applications has become more and more crucial. We may overcome these difficulties by optimizing the blower's performance and lowering energy loss by using a computer-controlled blower system. By reducing staff involvement, mechanization may additionally boost operational safety, especially in dangerous areas [1].

***Author for Correspondence**
Shashank Gupta
E-mail: guptashashank0810@gmail.com

Student, Department of Automation and Robotics, Guru Gobind Singh Indraprastha University, Sector-16C, Dwarka, New Delhi, India

Received Date: July 02, 2023
Accepted Date: July 17, 2023
Published Date: July 27, 2023

Citation: Shashank Gupta. Design and Development of an Automatic Blower System for Improved Efficiency in Industrial Applications. International Journal of Advanced Robotics and Automation Technology. 2023;1(1): 10–14p.

Objective

These are the major aims of this investigation:

1. To build an autonomous blowing system with sophisticated algorithms for management and cognitive features.
2. Need to integrate instruments into the airflow system to keep track of important variables like temperature, humidity, and air quality.
3. To generate efficient controlling algorithms that, using real-time data from the sensors, optimize the function of the blower.

4. To assess an automated blower system's achievement in terms of energy economy, air movement efficiency, and general system dependability.
5. To illustrate the computer-controlled blower system's benefits and room for growth by contrasting its capabilities with those of conventional manually operated methods.

By achieving these goals, we hope to progress technological innovations used in manufacturing processes while encouraging green living, savings on energy, and improved productivity.

LITERATURE REVIEW

Blower Systems for Industrial Use

In numerous manufacturing processes such as ventilation, cooling, and transportation of materials, blower systems are essential [2]. They are frequently utilized in factories, stores, power plants, and chemical processing facilities, among other places. These networks are created to create a regulated airflow to satisfy specific requirements by moving air or gases through ducts or conduits. Typical control mechanisms for traditional blower systems include fixed speed settings or manual adjustments. Nevertheless, these systems frequently lack the adaptability to change as circumstances do, leading to wasted electricity and less-than-ideal functioning (Figure 1).

Existing Control Methods

In industrial applications, a variety of control techniques have been used to increase the effectiveness of blower systems. Variable frequency drives (VFDs) are a popular method for managing the blower's motor speed. By allowing the blower to run at various speeds depending on the demand, VFDs enable energy savings by preventing continuous full-speed running. Utilizing pressure or flow sensors to provide feedback for regulating the blower output is another control strategy. It is possible to maintain the desired conditions by monitoring the pressure or flow in the system and adjusting the blower speed. These control techniques can't fully optimism the blower's performance in real-time because they still rely on manual modifications [3–5].

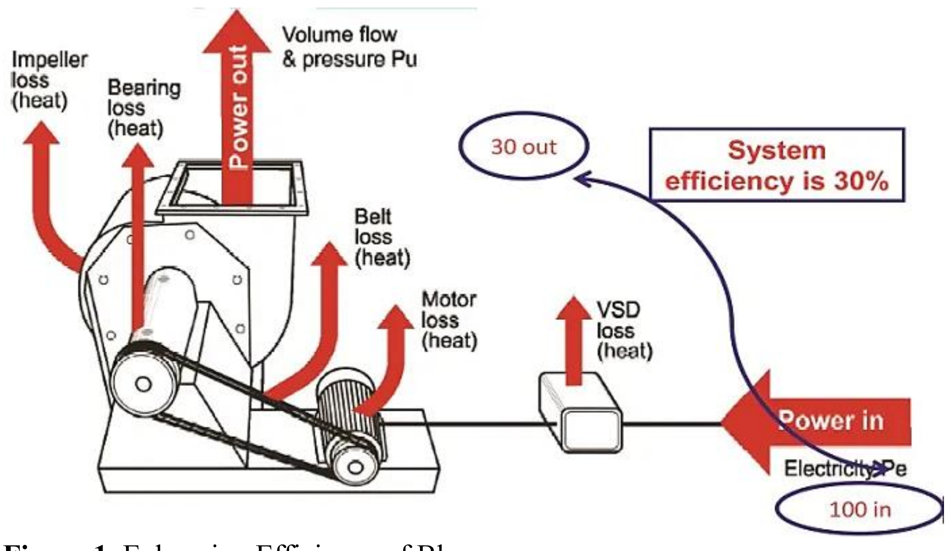

Figure 1. Enhancing Efficiency of Blower.

Commercial and Industrial Automation

In manufacturing environments, automation has drawn a lot of interest because it can increase output, effectiveness, and safety [6]. The development of automated systems in different industrial applications has been assisted in recent years by improvements in sensor technology, data processing, and control algorithms. Real-time monitoring, intelligent decision-making, and adaptive control based on changing circumstances are made possible through automation. Robotics can result in improved energy efficiency, precise control, and less need for humans to participate in blower systems. Blower systems can considerably increase their potential for energy savings and improved performance by including sophisticated characteristics as well as management algorithms.

The necessity for the creation of an automatic blower system with sophisticated control algorithms and intelligent features to enhance performance, cut energy use, and boost overall efficiency is established [7].

METHODOLOGY

System Architecture

Establishing the automatic blower system's architecture is the initial stage in building it. The system architecture outlines the parts, linkages, and interactions among the various system pieces. The blower unit, sensors, control panel, and human-machine interface (HMI) are all included. The control unit comprises a microcontroller or programmable logic controller (PLC), which processes data and regulates the operation of the blower [8]. The blower unit may be made up of a motor, impeller, and housing. Operator interaction and monitoring are made possible through the HMI.

Integration of Sensors

Several sensors are included in the blower system to enable intelligent control and optimization. These sensors keep an eye on important variables like air quality, pressure, humidity, and temperature. The choice of sensors is based on the specifications of the industrial application. For instance, in a ventilation system, pressure sensors can track the airflow while temperature and humidity sensors can report on the surroundings. Additionally, pollution or other contaminants might be found using air quality sensors. The control unit receives the sensor data and uses it to analyze and make decisions [9].

Design of Control Algorithms

The automatic blower system's control algorithm, which optimizes the blower's functioning based on sensor data, is its brain. There are various steps involved in the control algorithm design. The system specifications and intended performance criteria, such as energy effectiveness, airflow rate, and pressure control, are first defined. Next, appropriate control strategies are chosen based on the dynamics and goals of the system, such as proportional-integral-derivative (PID), model predictive control (MPC), or fuzzy logic control. The control method is subsequently put into practice in the control unit while accounting for feedback signals and sensor data [10]. The blower's speed or other parameters are continuously adjusted by the algorithm to preserve the optimum operating conditions and enhance performance.

RESULT

Analysis of Energy Efficiency

Data on energy consumption and airflow performance are gathered and analyzed to assess the autonomous blower system's energy efficiency. Power meters linked to the blower unit are used to measure energy consumption. At various places throughout the system, the airflow rate and pressure are measured to evaluate the airflow performance. The automatic blower system and conventional manual control techniques are contrasted. The outcomes show how the autonomous system was able to save energy thanks to optimized operation and adaptive control techniques. The effect of various operating circumstances on energy efficiency is also considered in the analysis.

Performance Assessment

Based on a variety of performance measures, including airflow rate, pressure control, response time, and stability, the automatic blower system's performance is assessed. Different scenarios that replicate the normal operating circumstances in industrial applications are used to conduct experimental tests. It is determined whether the system can keep the desired airflow rate and pressure within the predetermined limits. It is also measured how long it takes the system to respond to changes in demand or the external environment and achieve the required operating conditions. It is determined whether the system is stable, or whether it can function without oscillations or instabilities. The outcomes show that the automatic blower system outperformed manual control techniques in terms of performance.

Comparison with Manual Control Methods

To assess the advantages of the automatic blower system over conventional manual control methods, a comparative analysis is done. The automatic system's energy usage, performance, and operational traits are contrasted with those of manual control techniques like fixed-speed operation or human changes based on routine inspections. The analysis focuses on the benefits of the autonomous system, such as increased energy economy, exact control, less need for human involvement, and adaptability to shifting operational conditions. The contrast emphasizes how crucial automation is for industrial applications to achieve peak performance and energy savings.

The findings and comments in this part show how much more energy-efficient and effective the automatic blower system is when compared to conventional manual control methods.

DISCUSSION

Cost advantages and Energy Savings

Comparing the automatic blower system to conventional manual control methods, significant energy and financial savings are possible. The technology makes sure that energy is used effectively by continuously monitoring and adjusting the blower's performance based on current data. By adjusting the blower's speed and other factors to match the required airflow and pressure, the adaptive control algorithms prevent energy waste during time of low demand. The autonomous system's energy savings result in lower energy expenses for industrial buildings. Additionally, the reduced carbon footprint from the increased efficiency promotes sustainable behaviors and environmental preservation.

System Maintaining and Reliability

The automatic blower system's dependability and maintenance requirements are essential for its effective use in industrial applications. The incorporation of sensors enables preventive maintenance and offers useful feedback on the system's operation. It is possible to identify potential problems or irregularities early on because of real-time monitoring of parameters like temperature, pressure, and air quality. With this proactive strategy, downtime is decreased, and expensive breakdowns are avoided. The automated process also limits human involvement, lowering the possibility of human error and increasing operational safety. To guarantee the system's long-term dependability, routine maintenance is required, including sensor calibration and system checks. The autonomous blower system needs to be built with simple maintenance features, like self-diagnosis tools and opportunities for remote monitoring. To guarantee effective operation and identifying and maintenance staff should receive the appropriate training plus information.

Future Improvements and Scalability

The creation of the automatic blower system creates room for expansion and future improvements. The control algorithms can be improved further to incorporate machine learning strategies for adaptive and predictive control. The ability to analyses previous data and understand the behaviors of the system using machine learning models enables even more precise control and energy optimizations.

Industrial applications must take scalability into account because different facilities may have different needs and configurations. The autonomous blower system should be created with modularity and adaptability in mind, making it simple to integrate into various situations. To provide a comprehensive and integrated approach to industrial operations, it should also be able to interact with other industrial automation systems, such as building management systems or process control systems.

CONCLUSION

The design and development of an automatic blower system for increased productivity in industrial applications were reported in this research article. Advanced control algorithms, sensor technologies, and intelligent features can all be used to improve performance, optimist operation, and save energy. The advantages of the automatic blower system over conventional manual control techniques were made clear by the results of the energy efficiency study and performance evaluation. Significant energy savings, precision control, less need for human interaction, and adaptability to shifting operational conditions are all features of the system. The debate emphasized the value of automation in industrial applications by highlighting the financial advantages, system dependability, and maintenance considerations. The appropriate use of the automatic blower system promotes long-term and economical operations in industrial settings. The study's findings set the stage for future developments in automated systems that will boost productivity, energy efficiency, and operational safety. The autonomous blower system has the potential to revolutionize industrial ventilation, cooling, and air circulation as future improvements and scalability are investigated, resulting in more sustainable and effective industrial practices.

REFERENCES

1. D. Kong, Y. Zhou, Y. Liu, and L. Xue, “Using the data miningmethod to assess the innovation gap: a case of industrialrobotics in a catching-up country,” Technological Forecastingand Social Change, vol. 119, pp. 80–97, 2017.
2. A. A. Lubnina, M. V. Shinkevich, E. N. Yalunina,I. V. Gaidamashko, A. F. Savderova, and M. A. Komissarova,“Innovative strategy for improving the efficiency of industrialenterprises management,” Revista Espacios, vol. 39, no. 9, 2018.
3. R. E. Breaz, O. Bologa, and S. G. Racz, “Selecting industrialrobots for milling applications using AHP,” Procedia Com-puter Science, vol. 122, pp. 346–353, 2017.
4. L. Diao, J. Tang, P. C. Loh, S. Yin, L. Wang, and Z. Liu, “Anefficient DSP–FPGA-based implementation of hybrid PWM forelectric rail traction induction motor control,” IEEE Transactionson Power Electronics, vol. 33, no. 4, pp. 3276–3288, 2018.
5. J. Wu, D. Zhang, J. Liu, and X. Han, “A moment approach topositioning accuracy reliability analysis for industrial robots,”IEEE Transactions on Reliability, vol. 69, no. 2, pp. 699–714,2020.
6. A. Burghardt, D. Szybicki, P. Gierlak, K. Kurc, P. Pietru´s, andR. Cygan, “Programming of industrial robots using virtualreality and digital twins,” Applied Sciences, vol. 10, no. 2,p. 486, 2020.
7. L. D. Evjemo, T. Gjerstad, E. I. Grøtli, and G. Sziebig, “Trendsin smart manufacturing: role of humans and industrial robotsin smart factories,” Current Robotics Reports, vol. 1, no. 2,pp. 35–41, 2020.
8. X. V. Wang and L. Wang, “A literature survey of the robotictechnologies during the COVID-19 pandemic,” Journal ofManufacturing Systems, vol. 60, pp. 823–836, 2021
9. S. Li, R. Batra, D. Brown et al., “Particle robotics based onstatistical mechanics of loosely coupled components,” Nature,vol. 567, no. 7748, pp. 361–365, 2019.
10. T. Saleh and M. Khan, “Modular robotic platform for au-tonomous machining,” International Journal of AdvancedManufacturing Technology, vol. 105, no. 5-6, pp. 2557–2567,2019.

