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E-Support System for Identifying the Compressor

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Abstract

An E-Support system is an online system that provides users with support and assistance for various products or services. These systems are available 24/7, which means that customers can get the help they need at any time. The project is to implement and help people through online by developing the online website for compressor. This can be accessed online from any part of the world. It is a user - friendly website and was developed in visual studio code using java script, html and CSS. This website will assist to know more about the compressors like the details of pressure of the compressor, temperature of the compressor etc. It provides the details about the compressor. It is used to detect fault in the compressor and notify the customer about the fault. The developed website is used to know the customers online. For example, if the customer wants to buy an oil lubricated or oil free compressors then the website can be used. If any fault occurs in the air compressor the fault can be identified in troubleshooting. The customers can use this user-friendly website for checking compressors. The main objective is to provide better service and make the process easy for the customer to see the details about the compressors. The customer can make use of the website to explore about compressors.

Keywords: E-Support System, Compressor, Fault, Online Website.

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Introduction

This is to help customers with multiple ways to interact with specific needs with respect to Compressor selection and technical support. It helps to improve the compressors life time by suggesting best practices, and troubleshooting. The main page contains Sales, Service & Support and My Compressor. The sales page is used to select the compressor which required the air flow and air pressure [1]. If the customer knows about the air flow and pressure then it proceeds to the next page to enter the air pressure as bar and air flow as cfm. If the bar and cfm match then it fetches the particular compressor with option in litters of tanks. If the bar and cfm doesn't match the compressors then it shows a request message as "for the requested pressure and air flow please check with for screw compressor products".

If the customer is new for selecting the compressors, there are few questions to help the customer to select the type of application to calculate the air flow there are four applications which are Pneumatic cylinder, Nozzle, Industrial pneumatic tools and Garage pneumatic tools. Pneumatic cylinder has diameter of cylinder, stroke length, pressure for actuation, number of strokes and number of cylinders these are used to calculate the air flow. Nozzle has nozzle or orifice diameter, required pressure and number of nozzles [2]. Industrial pneumatic tools are to calculate the air flow when the quantity is entered. There are many types of tools like air bushing, air filter cleaner, air hammer light & heavy, air hoist 1000lb, air motor-1 & 2 hp, backfill tamper, bread breaker, bench rammer, etc, Garage Pneumatic tools are portable which is also used to calculate the air flow by entering the quantity.

The view products are a part of sales page which contains the entire details of the compressor. There are two variants of compressors which are Oil Lubricated and Oil Free. Oil lubricated products are aluminium coaxial reciprocating air compressors, LD series reciprocating air compressor 2.2-7.5 KW, Industrial, cast-iron reciprocating air compressor 3-40HP, two stage High volume oil lubricated reciprocating compressor, High pressure reciprocating air compressor 3- 20HP/up to 60 bar, PET high pressure reciprocating compressor, High pressure & super pressure reciprocating air compressor [3]. Similarly, Oil free products are 1-4HP single-stage direct drive reciprocating air compressor, 5-15HP two-stage reciprocating air compressor. In common all these compressors have model, motor power, tank capacity, piston displacement, max pressure, speed, number of cylinders, free air delivery and net weight. Oil lubricated compressors has some add on like overall unit dimensions, type of mounting, tank, weight and dimensions in mm. Oil free compressors have model with dryer.

Service & Support page has best practices and troubleshooting tips to help the customer to detect the fault. Troubleshooting has cause and suggested solution for both oil lubricated and oil free products.

Troubleshooting helps the customer to find the problem and it also suggest solutions to the compressors, oil lubricated has causes and solutions for compressor overheats, oil leak through breather valve, oil carry over in compressed air, unusual wear of cylinder piston and piston ring, compressor knocking, excessive time for pressure built up, compressor does not unload, unloader valve leaky, starter/pressure switch/motor, starter/pressure switch/motor [4]. For example, the customer finds out that the compressor overheats, cause and suggested solutions.

Oil Lubricated

Table 1: Compressor Overheats

Cause	Suggested solution
Dirty/non-recommended oil	Change with correct grade of oil
Low oil level	Fill oil up to maximum level in the oil level indictor
Breather valve not working	Open, clean and refit after checking.
Wrong direction rotation	Interchange any of the income terminal to the motor
High ambient temperature	Ensure the compressor room temperature is less than 45deg C. Provide proper ventilation

Table 2: Starter / Pressure Switch / Motor

Cause	Suggested solutions
Low voltage supply/ voltage fluctuation	Ensure constant incoming voltage 380V and above
Sparking of contact/ melted contact points in pressure switch	Replace pressure switch
Sparking of contact/ melted contact points in	Replace the contactor and ensure the glands are sealed to prevent dust entry

starter	
Short circuit (motor)	Check and correct the short circuit. Replace with rated fuse
Wrong OLR setting	Change OLR setting as per recommendation
Starter trip	Check and change pressure setting as per recommendation. Check and change the NRV. Check and ensure no of starts/stops <10 times/hours by increase the air receiver size or recommend external air receiver if not available. Check and remove the loops lines. Check and correct the short circuit.
Single phasing	Check and ensure three phase incoming supply
Motor not working	Repair or replace the motor
Voltage fluctuation	Check and ensure three phase incoming supply

Similarly, oil free type compressor is divided into three stages namely Single stage (1 HP), Single stage (2,4 HP) and two stage (5,7.5,10,15 HP). The single stage(1HP) has causes which are pressure drop in the tank, compressor does not get to the set pressure and overheats too much, compressor knocking, compressor stopped and does not start, compressor does not stop even at set pressure and compressor not loading [5]. The single stage (2,4 HP) has few causes they are pressure drop in the tank, compressor does not get to the set pressure and overheats too much, compressor knocking, compressor stopped and does not start, compressor does not stop even at set pressure, compressor not loading, drain not working during unloading of the compressor, to find outlet dew point temperature (- 7 PDP). Two stages (5,7.5,10,15 HP) has because which is same as oil lubricated, they are compressor overheats, unusual wear of cylinder piston and piston ring, compressor knocking, excessive time for pressure built up, compressor does not unload, unloader valve leaky, starter/pressure switch/motor, starter/pressure switch/motor.

Oil Free

Single Stage (1 HP)

Table 3: Pressure Drops in the Tank

cause	Suggested solution
Air leaks at connections	Make the compressor get to maximum pressure. Switch it off and brush a soapy water solution on to all connections. Look carefully for air bubbles flowing on. Tighten those connection where leaks are present.

Table 4: Compressor does not get to the set Pressure and Overheats too Much

cause	Suggested solutions
Compressor head gasket broken	Replace head gasket
Reed valves not sealed properly or broken	Replace read valves kit
Worn out NRV seat	Replace NRV kit

Table 5: Compressor Knocking

cause	Suggested solutions
Bearing seizure	Replace related components
Worn out piston, cylinder crankshaft and connecting rod bearings	Overhaul compressor unit. Replace the related components
Valve seat of NRV worn out	Replace NRV kit

Service & support also has best practices like check oil level, temperature control, air filters, spares, drain the condensate, maintenance schedule, clean the components, check the fasteners and check belt alignment.

Table 6: Best Practices

Check oil level Check oil level every day and top up the oil whenever required with air lube oil.
Temperature control Implement proper ventilation and cooling to prevent compressor overheating.
Air filters Keep the filters clean to prevent dirt and dust formation.
Spares Use genuine spares only to prevent unexpected compressor breakdowns.
Drain the condensate Drain the condensate from the drain valve to prevent water vapor in compressed air.
Maintenance schedule Follow the maintenance schedule which provides information regarding timely maintenance. Regular maintenance help in energy savings and low maintenance costs.
Clean the components Clean the components such as flywheel, cylinder fins, heads, coolers etc to prevent dirt from insulating the components and excessive heat build-up.
Check the fasteners Check the fasteners on a regular basis and tighten them if required.

Check belt alignment
Check belt alignment between the compressor pulley and the motor pulley before starting the compressor.

Related Works

Malla et al [6] designed reciprocating air compressor is examined and tested for noise and vibration in order to identify any mechanical or other flaws. Here, the study of the vibration signature and the reciprocating compressor's noise harshness level are measured. Following the test, the compressor's malfunctioning component was changed, and the test was run once more. To investigate and assess the root cause of faults, microscopic examination of bearing components was also conducted. Here, the NVH has significantly improved.

Ayoub [7] proposed study is to examine the total energy usage of an industrial compressed air system and determine how different energy-saving measures taken by specific subsystems affect the system as a whole. To evaluate energy consumption and identify areas for potential energy savings, two new factors are introduced: process effectiveness (~) and energy efficiency (η). With consideration for the modeling of the separate sub-system components—air compressor, after-cooler, filter, drier, and receiver—an analytical energy model for air compression of the entire system was developed. The theoretical thermodynamic technique was used to incorporate the evolution of energy consumption in each subsystem's analytical energy model. In addition, the system's overall efficiency calculation used pipe friction loss and pressure loss models for individual components.

Vu et al [8] designed to give the best description possible of the exponent of the chance of the second kind of error for the fixed compression mappings scenario in the event that the database's user count increases exponentially. Next, we demonstrate the operational equivalency relations among the identification systems with user-dependent compression mappings, the single-user hypothesis testing problem, the multi-user hypothesis testing problem, and the Wyner-Ahlswede-Körner network. These equivalency relations imply the exponentially strong converse and the strong converse for both the identification systems and the multi-user hypothesis testing with user-dependent compression mappings. Lastly, they demonstrate how a multi-user hypothesis testing scheme can be created from an identification scheme by explicitly transferring the rate and error probability criteria, and vice versa.

Divya et al [9] provides an efficient model based on real-time empirical acoustic sensor time-series data collected at a 50 kHz sampling frequency for the categorization of air compressor faults. Fast Fourier transformations are used in the proposed work to translate the time series data into the frequency domain, where half of the signals are taken into account because of their symmetric representation. Subsequently, an extraction of important feature vectors input into the multilayer sensory neural network is done through a masking operation. The suggested method is distinct in that it necessitates fewer trainable parameters, which cuts down on training time and memory overhead.

Desmet and Delore [10] approach connects the activation of each air-powered component with patterns in the pressure drop from the accumulator through machine learning.To reveal patterns in the time-frequency domain, we first subject the accumulator pressure trend to a wavelet transform. Next, we choose the most informative wavelet scales by utilizing the feature importance of the Random Forest approach. Lastly, we test two different anomaly detection techniques on the chosen inputs: the first employs a neural-network approach (autoencoder) and the second uses a clustering approach (LOF). Following the completion of the learning phase (using historical data), we test the system on an intermittent leak that only happens when a specific component is turned on. We discover that both systems function well, with the LOF trading speed for accuracy in relation to the auto encoder.

Proposed Methodology

This is to help customers with multiple ways to interact with specific needs with respect to Compressor selection and technical support. It helps to improve the compressors life time by suggesting best practices, and troubleshooting. The main page contains Sales, Service & Support and My Compressor. The sales page is used to select the compressor which required the air flow and air pressure. If the customer knows about the air flow and pressure then it proceeds to the next page to enter the air pressure as bar and air flow as cfm. If the bar and cfm match, it will get the specific compressor with a tank choice in litters. The message "for the specified pressure and air flow please check with screw compressor products" appears if the bar and cfm don't match the compressors. There are a few questions to help the customer choose the type of application to calculate the air flow if they are choosing compressors for the first time. There are four applications: pneumatic cylinders, nozzles, industrial pneumatic tools, and garage pneumatic tools.

The goal of the project is to implement and assist people online by creating an online compressor website. Anyone in the globe can access this via the internet. The website was created in visual studio code utilizing java script, html,

and CSS, and it is user-friendly. This website helps users learn more about compressors, including information about the compressor's temperature and pressure. It offers information on the compressor. It is used to identify compressor faults and inform the consumer of the issue by offering potential fixes. Online customer tracking is done using the built website. For instance, if a consumer wishes to purchase an oil-lubricated or oil-free compressor, they can utilize the website to explore items and learn more about the compressors in depth. If an issue with the air compressor arises, troubleshooting will reveal the issue.

Customers can use this app in a variety of ways to interact with it for their particular technical support and compressor selection needs. By offering best practices and troubleshooting advice, it increases the compressors' lifespan. Customers may inspect compressors using this user-friendly website.

Advantages

Improved Customer Experience

An envelope web application with 3D and VR apps-based troubleshooting guide can provide an enhanced customer experience. Customers can easily navigate through the application to find solutions to their problems, thereby reducing the time and effort required to troubleshoot issues.

Increased Efficiency

With the help of a 3D and VR-based troubleshooting guide, reciprocating compressor dealers and customers can quickly and easily identify and diagnose problems. This can lead to increased efficiency and productivity, as well as reduced downtime and maintenance costs.

Better Communication

The envelop web application can improve communication between dealers and customers. Dealers can provide real-time support and advice through the application, and customers can easily share their concerns and problems with dealers. This can lead to improved customer satisfaction and loyalty.

Enhanced Training

A 3D and VR-based troubleshooting guide can also be used as a training tool for dealers and customers. It can provide a visual and interactive learning experience, making it easier for them to understand the working of the compressor, its components, and the maintenance procedures.

Disadvantage

Technical Requirements

To use the envelop web application, customers and dealers must have access to the required hardware and software, including a compatible device, internet connection, and VR headset. This can be a barrier for those who do not have access to these technologies.

Cost

Developing an envelope web application with 3D and VR apps can be expensive, especially for small businesses or individual customers. The cost of the hardware and software required to use the application can also be high.

User Experience

The application's user interface and design must be intuitive and user-friendly for customers to use the application effectively. Otherwise, it may lead to frustration and confusion, resulting in reduced customer satisfaction and loyalty.

Reliance on Technology

The application's effectiveness and usefulness depend on the accuracy and reliability of the technology used to develop and run the application. Any technical issues with the application can cause delays and frustration for customers, leading to reduced customer satisfaction.

System Environment

Table 7: Hardware Specification

Processor	Core i3

RAM Capacity	1GB
Hard Disk	160 GB
Mouse	Logical Optical
Mouse Keyboard	104 Keys
Monitor	16 inches
Mother Board	Intel
Speed	2GHZ
Floppy Disk Drive	100MB

Table 8: Software Specification

Front End	HTML, CSS
Java script Environment	Visual studio code

Results and Discussion

Input Design

Input design converts the user-oriented inputs to computer-based formats. Inaccurate input data are the most common cause of errors in the data processing. The goal of designing input is to make the data easy. The proposed system is complete website. It is a powerful tool for interactive design.

Therefore, the quality of system input determines the quality of system output. Well-designed input forms and screens have following properties –

- It should serve specific purpose effectively such as storing, recording, and retrieving the information.
- It ensures proper completion with accuracy.
- It should be easy to fill and straightforward.
- It should focus on user's attention, consistency, and simplicity.
- All these objectives are obtained using the knowledge of basic design principles regarding What are the inputs needed for the system?
- How end users respond to different elements of forms and screens

Input Screen

Fig 1: represents a mobile app that customers had to download from the Play Store and fill out with their email address, name, cell phone number, and pin code. Memory space is needed, as well as installation time. If the consumer is aware of the compressor's air pressure and air flow, finding the right compressor is simple. Learning about compressors, their troubleshooting techniques, and recommended procedures is simple and login page.



Fig. 1: Main Page

In Fig 2, A mobile app that customers had to download from the Play Store and fill out with their email address, name, cell phone number, and pin code.

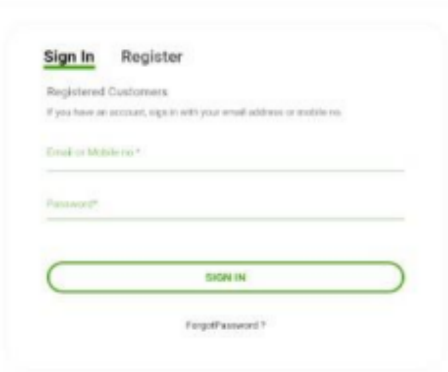


Fig. 2: Login Page

Output Design

The design of output is the most important task of any system. During output design, developers identify the type of outputs needed, and consider the necessary output controls and prototype report layouts. Manufacturers create and design external outputs for printers. External outputs enable the system to leave the trigger actions on the part of their recipients or confirm actions to their recipients. Some of the external outputs are designed as turnaround outputs, which are implemented as a form and re-enter the system as an input. Internal outputs are present inside the system, and used by end-users and managers. They support the management in decision making and reporting. The objectives of input design are:

- To develop output design that serves the intended purpose and eliminates the production of unwanted output.
- To develop the output design that meets the end users' requirements.
- To deliver the appropriate quantity of output.
- To form the output in appropriate format and direct it to the right person.
- To make the output available on time for making good decisions.

Output Screen

Fig 3 describes the main page contains Sales, Service & Support and My Compressor. The sales page is used to select the compressor which required the air flow and air pressure. If the customer knows about the air flow and pressure then it proceeds to the next page to enter the air pressure as bar and air flow as cfm**.**

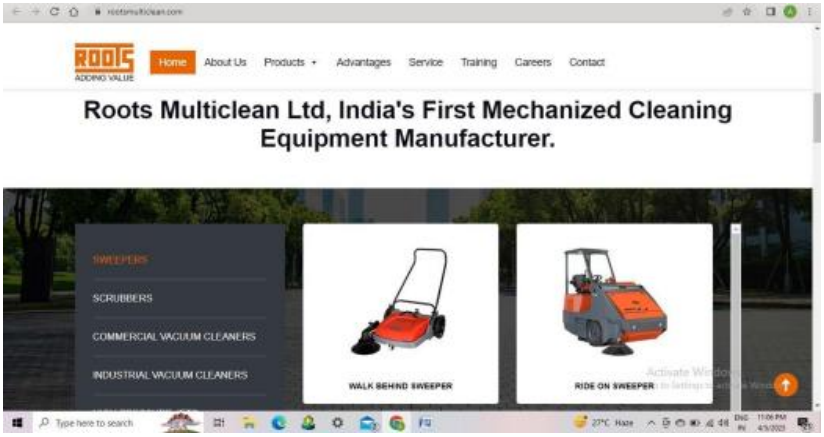


Fig. 3: Output Design for Support Management

Fig 4. represents the bar and cfm match, it will get the specific compressor with a tank choice in liters. The message "for the specified pressure and air flow please check with screw compressor products" appears if the bar and cfm don't match the compressors. There are a few questions to help the customer choose the type of application to calculate the air flow if they are choosing compressors for the first time. There are four applications: pneumatic cylinders, nozzles, industrial pneumatic tools, and garage pneumatic tools.



Fig. 4: Compressor Design

Fig 5. describes that the website helps users learn more about compressors, including information about the compressor's temperature and pressure. It offers information on the compressor. It is used to identify compressor faults and inform the consumer of the issue by offering potential fixes. Online customer tracking is done using the built website. Customers can use this app in a variety of ways to interact with it for their particular technical support and compressor selection needs. By offering best practices and troubleshooting advice, it increases the compressors' lifespan. Customers may inspect compressors using this user-friendly website.

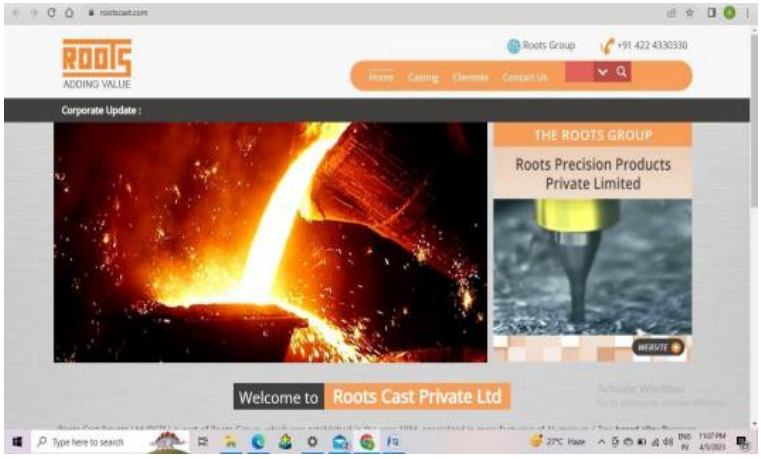


Fig. 5: Compressor Selection

Conclusion and Future Scope

As the technology emerges day by day this website will be more useful for the customers as well as the organization to see or show the products of the compressor. This project is very efficient and saves time for both customers and organization. The customers can know more about the types of compressors in detail on the website. This will be very useful as the website contains all the details about the compressor. Compressors are used throughout the industries to provide shop or instrument air, to power air tools, paint sprayers, air conditioning, refrigeration etc. So, this online website will be more useful to pick the details about the compressor.

Future Scope

The future scope for providing reciprocating compressor dealers and customers with 3D and VR apps based on trouble shooting guide is promising. Here are some potential benefits and opportunities:

Enhanced customer experience: 3D and VR apps can provide an immersive and interactive experience to customers, enabling them to troubleshoot issues on their own, reducing the need for on-site visits and downtime.

Reduced costs: By providing customers with a self-service option for troubleshooting, dealers can reduce the need for field service technicians, which can significantly reduce the cost of maintenance and repair.

Improved efficiency: 3D and VR apps can provide detailed visual aids and step-by-step instructions to help dealers and customers troubleshoot problems faster and more accurately, improving efficiency and reducing downtime.

Competitive advantage: By offering innovative 3D and VR troubleshooting solutions, dealers can differentiate themselves from their competitors and position themselves as industry leaders in customer service and support.

Data insights: 3D and VR apps can also provide dealers with valuable data insights into the performance of their compressors, enabling them to identify potential issues early and take proactive steps to prevent downtime and costly repairs.

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