Testing the Compressors Performance Using a Mobile Application

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Abstract--- Nowadays compressor plays the main role in many industries. ELGI plays an important role in manufacturing the best compressors like the railway compressors which plays an important role in suppling compressed air for operation of air brakes, VCB, SMGR (in conventional loco), horns, wipers and other pneumatically controlled equipment. A compressor is a mechanical device that increases the pressure of a gas by reducing its volume. The readings collected by the employees are stored in this app to detect the state of the compressor. The readings collected will help the employees to know the pros and cons of the compressor in the testing period. This app is created through MIT app developer. This app contains 5testrings and each test rig contains four tests that takes place in an interval of 30mins.After collecting the readings the data are sent as a mail to the person in charge and also the readings which is sent will be stored in share point in the backend. Here the readings collected will be managed by a team where they will check whether they are in the range / fixed value. If not, then the compressor undergoes analysis. Every past reading will also be stored in the share point which will help the person to know the past working of the compressor. Once when the team approves the readings of the compressor then they get the approval and the other processes take place.

Keyword--- Mobile Application, Railway Compressor, MIT App Developer.

I. Introduction

The aim of the paper is to develop an android application for railways aswell as for company to maintain the daily process of air compressor details [1]. As the usage of devices such as mobile phones and tablets are high now a day, it is easy to take readings and do the calculations in their own devices. This application deals with the storing Compressor Information details, compressor testing information for every 30 min interval (Count of 4 times) as TEST1, TEST2, TEST3, TEST4 details, final reading details and calculated value details in mobile phone [2]. This project is used to record its day-to-day compressor reading details in an efficient manner.

This application stores the compressor testing readings from which state of the compressor is determined and then these reading are sent as E-mail to the testing engineer [3]. By using this application, we can save the time, data can be handled easily, data will be available in company’s database. If there is any need for that data, it can be retrieved from the database.

Using this application, the loss of the information of the compressors is being reduced [4]. This proposed app has been developed with an intention to make a user-friendly application andto reduce the manual work [5]. The system has been developed with advanced features. The objectiveof our project is to establish mobile application to maintain all the details of Air compressors which is used in trains. This project will serve the following: Maintains the records of readings, Sends the data of air compressor carefully, Calculates the values automatically, shows warning message if the data is wrong, automatically sends the mail to the respected person, Provides the accurate data.

The existing system of railway compressor testing app was just based on paper and a pen. The employee used to note down the readings in the paper and the calculations were also made by an employee. This existing system created many problems in noting down the readings, the calculations. Some readings where not on point the values get differed on each testing process. This process took a lot of energy and human resource. Sometimes only few tests were made and sometimes the time gap between the readings will differ and it won’t be accurate. There may be achance of losing the data as it is not stored properly. Also, the data collected can’t be used for future purposes. Disadvantages of Existing System: Increased time consumption, It is not secured, Readings can be missed, Repetitive tasks to take the readings, Process delay, Miscommunication, Duplication of the data readings and Requires high cost.

II. Literature Review

Benichou et al [6] In order to address distorted intake in axial fans or compressors, this research presents a semi-analytical method. Inspired by the classical theory of parallel compressors (PCs), it is based on a formalism of local flow-loading coefficients. It is used to investigate the aerodynamic behavior of a low-speed fan in response to upstream flow distortion under non-uniform flow conditions. Three-dimensional RANS simulations and experimental data are employed to assess the fan performance forecast made using the local PC approach. In spite of its simplicity, the comparison demonstrates that the current method accurately captures first-order events, providing intriguing insights for an early design stage if various fan shapes are to be tested and provided the upstream distortion maps are accessible.

Loganathan et al [7] In order to demonstrate the feasibility of the air audit system, the paper uses signals from an existing power quality analyzer, feeds them to a microcontroller, processes them, logs data, transfers bulk data over WiFi to the company or customer upon request, presents the data graphically through a mobile app, and generates reports. The development of an independent, battery-operated air auditing module that will be made available to customers and the sales engineer is another way to expand this effort. The study's main goal is to carry out air audits in a sector of the economy locally, without the help of a third party.

Chen et al [8] The suggested models seek to maximize the reliability of gas delivery while taking into account the strict operational limitations of a gas pipeline system and financial constraints (such as the total amount of standby power/units). Large-scale nonlinear programming (NLP) and mixed-integer nonlinear programming (MINLP) are the resulting optimization models for power standby and unit standby methods, respectively. We break down the initial large-scale model into two equivalent sub-problems in order to solve the unit standby optimization strategy efficiently. Optimizing the gas supply flow rate in different conditions by using preset compressor configurations is the first sub-problem. The second sub-problem is to optimize the standby scheme based on the answers obtained from the previous one. In order to confirm that the suggested methods are effective, numerical results are given.

Chiu et al [9] The process, techniques, and outcomes of an exercise that involved interviewing experts from stakeholder organizations throughout the energy system are presented in this study. Two general methods to heat decarbonization—adaptive and transformative—are shown by analysis of interview data. Our modelling teams were able to refocus their work for exploration with a wider circle of stakeholders thanks to specific insights gleaned from these conversations. The findings indicate that formalizing the model-policy interaction through an iterative process may strengthen the modeling's influence on policymaking and increase its legitimacy and transparency.

Zou et al [10] Electrochemical hydrogen compressors (EHCs) are gaining popularity because they are very efficient, modular, and have no moving parts for hydrogen purification. In light of all of this, this review will offer an overview of the many hydrogen compression methods and go over their respective architectures, guiding principles, benefits, and drawbacks for the first time. Along with future hydrogen compression techniques, containment membranes, catalysts, gas diffusion layers, and flow fields that correspond to them will all be thoroughly presented in this review. It will also cover the recent advancements and current problems with EHCs. Engineering viewpoints are also explored in order to improve the efficiency of EHCs with regard to heat management, water management, and EHC stack testing procedures.

III. PROPOSED METHODOLOGY

Now the railway compressor testing app is created. This app contains 5 testrig. Each testrig contains 4 test. That is each test takes place in a gap of 30minutes. Each testrig will also contain the compressor details, the calculated values and the final test values. After every testrig the readings will be sent as a mail to the person in charge and the readings will also be stored in the SharePoint. Here the calculations in each test is inbuilt according to its range.

Advantages of Proposed System

- The mobile app is more user friendly.
- The system works with high speed and accuracy.
- It handles bulk amount of data.
- Cost effective platform.
- Quick and easy to develop the android application.
- Faster deployment.
- Target multiple platforms.
- Versatility and Scalability.
- Enhanced security.
- Customization.
- Retrieval of data is possible.

3.1. Data Flow Diagram

DFD is the abbreviation for Data Flow Diagram. The flow of data of a system or a process is represented by DFD. It also gives insight into the inputs and outputs of each entity and the process itself. DFD does not have control flow and no loops or decision rules are present. Specificoperations depending on the type of data can be explained by a flowchart. It is a graphical tool, useful for communicating with users, managers and other personnel. it is useful for analyzing existing as well as proposed system.

It provides an overview of,

- What data is system processes.
- What transformation are performed.
- What data are stored.
- What results are produced, etc.

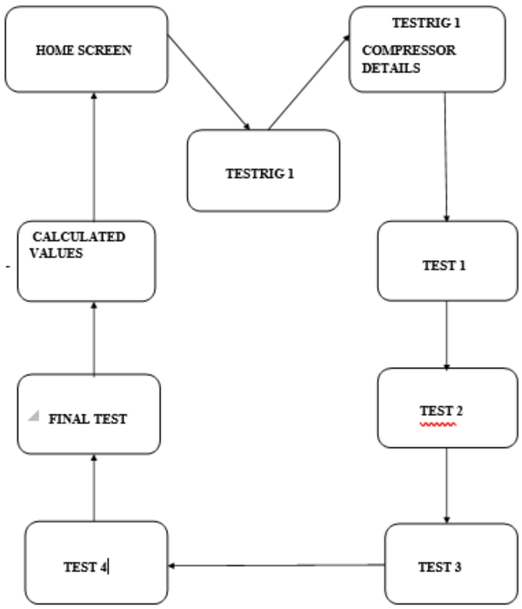

Figure 1 - Data Flow Diagram

3.2. Modules in the System

- Home Screen
- Testrig 1
- Testrig 2
- Testrig 4
- Testrig 5

Home Screen

It is the first module named home screen consists of five testrigs named (testrig1, testrig2, testrig3, testrig4, testrig5). From this module the user can navigate to all the testrigs.

Testrig1

Here this module contains testrig1 compressor information like date, operator name,fab no, motor serial no, motor make and four tests(test1,test2,test3,test4) where the readingsof the compressors are being entered. Each test takes place in an interval of 30mins. Next to this final test page appears. This is followed by the calculated values. After entering all the required readings, the email can be sent.

Testrig2

This module contains testrig2 compressor infomations like date, operator name, fabno, motor serial no, motor make and four tests(test1,test2,test3,test4) where the readings ofthe compressors are being entered. Each test takes place in an interval of 30mins. Next to this final test page appears. This is followed by the calculated values. After entering all the required readings the email can be sent.

Testrig3

This module contains testrig3 compressor infomations like date, operator name, fab no, motor serial no, motor make and four tests (test1, test2, test3, test4) where the readings ofthe compressors are being entered. Each test takes place in an interval of 30mins. Next to this final test page appears. This is followed by the calculated values. After entering all the required readings, the email can be sent.

Testrig4

This module contains testrig4 compressor infomations like date, operator name, fab no, motor serial no, motor make and four tests(test1, test2,test3,test4) where the readings ofthe compressors are being entered. Each test takes place in an interval of 30mins. Next to this final test page appears. This is followed by the calculated values. After entering all the required readings, the email can be sent.

Testrig5

This module contains testrig5 compressor infomations like date, operator name, fab no, motor serial no, motor make and four tests (test1, test2, test3, test4) where the readings of the compressors are being entered. Each test takes place in an interval of 30mins. Next to this final test page appears. This is followed by the calculated values. After entering all the required readings, the email can be sent.

IV. Software Specification

MIT App Inventor is a web application integrated development environment originally provided by Google, and now maintained by the Massachusetts Institute of Technology. It allows newcomers to computer programming to create application software (apps) for two operating systems : Android, and iOS, which, as of 8 July 2019, is in final beta testing. It is free and open- source software released under dual licensing.

MIT App Inventor is an intuitive, visual programming environment that allows everyone even children to build fully functional apps for smartphones and tablets. Those new to MIT App Inventor can have a simple first app up and running in less than 30 minutes. And what's more, our blocks-based tool facilitates the creation of complex, high-impact apps in significantly less time than traditional programming environments. The MIT App Inventor project seeks to democratize software development by empowering all people, especially young people, to move from technology consumption to technology creation.

A small team of CSAIL staff and students, led by Professor Hal Abelson, forms the nucleus of an international movement of inventors. In addition to leading educational outreacharound MITApp Inventor and conducting research on its impacts, this core team maintains the free online app development environment that serves more than 6 million registered users.

Blocks-based coding programs inspire intellectual and creative empowerment.MIT App Inventor goes beyond this to provide real empowerment for kids to make a difference -- a way to achieve social impact of immeasurable value to their communities.

Creative Commons Attribution ShareAlike 3.0 Unported license, and an Apache License 2.0 for the source code. App Inventor also supports the use of cloud data via its Cloud DB component and written in JavaSwift, Objective-C, Kawa, Scheme, JavaScript. It uses a graphical user interface

(GUI) very similar to the programming languages Scratch (programming language) and the StarLogo, which allows users to drag and drop visual objects to create an application that can run on Android devices, while an App-Inventor Companion (the program that allows the app to run and debug on) that works on IOS running devices are still under development. In creating App Inventor, Google drew upon significant prior research in educational computing, and work done within Google on online development environments.

Benefits of MIT App Inventor

- Everything is done through a select and drop manner. This means we can select aparticular chunk of code and drop in our code. Hence, no typing.
- Easy to test your app. We can check the app developed on desktop or laptop withthe app inventor application on our mobile phones.
- MIT provides the user with some basic lessons which help in building that apps and that helps in a proper understanding of how the MIT app inventor platform works for the user.
- Useful for novices.
- Power of native apps with a simple UI.

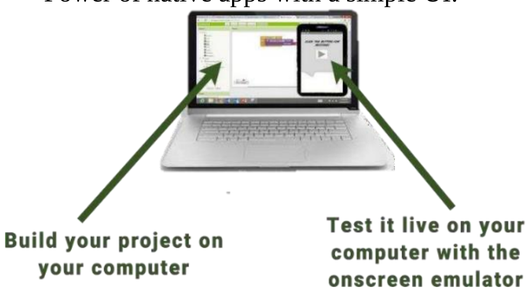

Figure 2 - MIT App Invertor

Coding Space of App Inventor

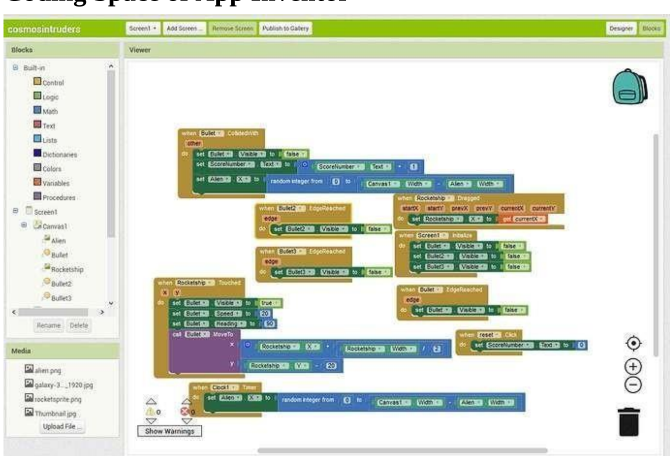

Figure 3 - Viewer Pane

Hardware Specification

Table 1: Hardware Specification

Processor	Core i3 RAM
capacity	1GB
Hard Disk	160 GB
Mouse	Logical Optical Mouse
Keyboard	104 keys
Monitor	6 inches
Mother Board	intel
Speed	2GHZ
Floppy Disk Drive	100 MB

Computer and Operating System Requirements

Table 2: Software Specification

Macintosh (with Intel processor)	Mac OS X 10.10+
Macintosh (with Apple Silicon)	Mac OS 12+
Windows	Windows 7+
GNU/Linux	Ubuntu 8+, Debian 5+

Browser Requirements

- Mozilla Firefox 54 or higher
- Apple Safari 11 or higher
- Google Chrome 55 or higher. App Inventor does not support MicrosoftInternet Explorer. Windows users should use Chrome or Firefox.

V. Result and Discussion

Input Design

In this application the inputs are given by the staff through this app. After navigating to the testrig 1 app through home screen. Then the inputs will be feeded to the app by the respective person. Each and every fields in the input is a mandatory one.

Every field in this app should contain some values in it. Some of the fields will be having rangeof value. In those fields, values should be entered within the range. Only if the value is in that range, it will proceed further, otherwise it throws a warning message (the entered value is not in the range).

After giving the inputs, it will move to the calculation process which is automated. As the formula was feeded at the backend, the values will be automatically generated and it will anemail.

Some of the fields in input screen are:

- Compressor name
- Compressor ID
- Date
- Compressor type
- Time
- Temperature
- Shaft speed
- Motor case no.
- Pipe from intercooler
- Pipe from after cooler
- Delivery air
- Air leak
- Leak status
- Ambient Temperature

Input Screen

Figure 4 - Testrig1-Compressor Detail Screen

Figure 5 - Testrig 1-Test Screen

Figure 6 - Testrig 1- Final Test Screen

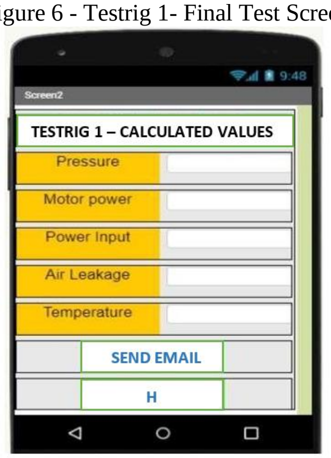

Figure 7 - Testrig 1-Calculated Values Screen

Output Design

The output will be visible in the Gmail section. Once the send mail button is clicked, automatically mail will sent to the respective officer. The id was pre-defined in the coding section. So that, the mail will be sent only to that particular mail id's. Once the mail is received, the data will be stored in the company database. If needed, it can be referred for future use. Apart from that, the data will be stored in SharePoint, so that the backup of the data will be there alwaysfor further reference.

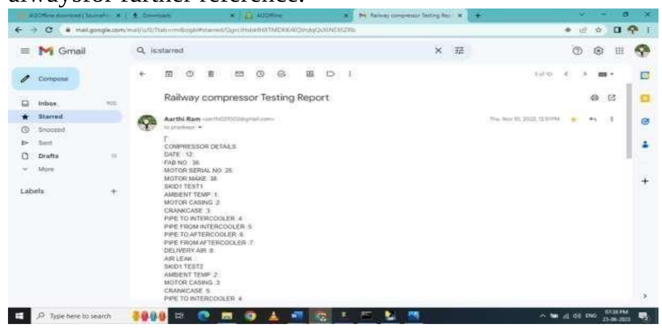

Figure 8 - Readings in Mail-1

Form Name: MAIL page

Form Description: The readings taken by the employee are sent to the testing engineer throughmail.

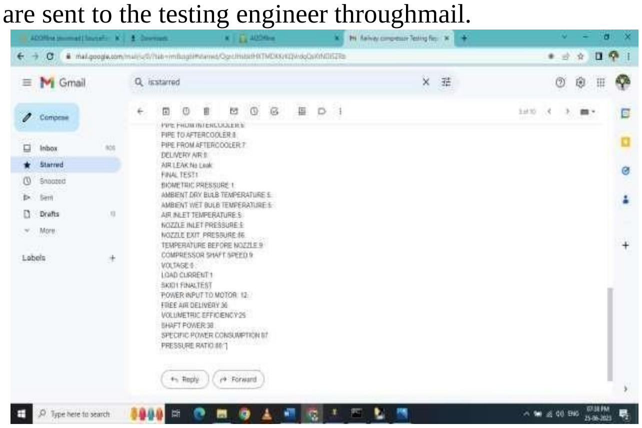

Figure 9 - Readings in Mail-2

VI. Conclusion

This mobile application is developed to make the works faster. Using this will reducethe workload. The human errors will not occur here. Time consumption is less whencompared to the existing system. This app makes the test person to collect the readings easily and the calculations are made easy. Here there is no need of any personal training for using this app. This app is user friendly and the readings are collected easily. This project will help the organization to maintain the data for future reference and to handle these data in an efficient way.

Reference

[1] Jin, J., Pan, J., Lu, Z., Wu, Q., & Xu, L. (2021). An investigation of a high-performance centrifugal compressor with a variable map width enhancement slot for proton exchange membrane fuel cell systems in commercial vehicle application. *Proceedings of the Institution of Mechanical*

Engineers, Part D: Journal of Automobile Engineering, *235*(1), 288-300.

[2] Ding, C., Xia, Y., Yuan, Z., Yang, H., Fu, J., & Chen, Z. (2023). Performance prediction for a fuel cell air compressor based on the combination of backpropagation neural network optimized by genetic algorithm (GA-BP) and support vector machine (SVM) algorithms. *Thermal Science and Engineering Progress*, *44*.

[3] Peng, Q., Bao, R., Li, J., Ren, J., Tang, J., Li, J., & Tong, Y. (2024). Centrifugal compressor performance prediction and dynamic simulation of natural gas hydrogen blended. *International Journal of Hydrogen Energy*, *52*, 872-893.

[4] Wei, Y., Li, B., Xu, X., Wei, M., & Wang, C. (2023). Design of Electric Supercharger Compressor and Its Performance Optimization. *Processes*, *11*(7), 1-18.

[5] Liu, Y., Zhao, Y., Yang, Q., Liu, G., Li, L., & Gao, Z. (2022). Performance study of centrifugal air compressor for proton exchange membrane fuel cell systems. *Energy Science & Engineering*, *10*(1), 208-218.

[6] Benichou, E., Binder, N., Bousquet, Y., & Carbonneau, X. (2021). Improvement of the Parallel Compressor Model and Application to Inlet Flow Distortion. *International Journal of Turbomachinery, Propulsion and Power*, *6*(3), 1-15.

[7] Loganathan, A.K., Alexander Stonier, A., Uma Maheswari, Y., Peter, G., & Samraj Lawrence, T. (2022). A real-time implementation of air audit system for compressors towards energy conservation: an industrial case study. *Mathematical Problems in Engineering*, *2022*.

[8] Chen, Q., Zuo, L., Wu, C., Li, Y., Hua, K., Mehrtash, M., & Cao, Y. (2022). Optimization of compressor standby schemes for gas transmission pipeline systems based on gas delivery reliability. *Reliability Engineering & System Safety*, *221*.

[9] Chiu, L. F., & Lowe, R. J. (2022). Eliciting Stakeholders' Requirements for Future Energy Systems: A Case Study of Heat Decarbonisation in the UK. Energies, 15(19), 1-21.

[10] Zou, J., Han, N., Yan, J., Feng, Q., Wang, Y., Zhao, Z., & Wang, H. (2020). Electrochemical compression technologies for high-pressure hydrogen: current status, challenges and perspective. *Electrochemical Energy Reviews*, *3*, 690-729.