International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 08 | Aug 2022 www.irjet.net p-ISSN: 2395-0072

Automation of Instrument Air Distribution System using Arduino and Integrate Industry 4.0

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Abstract- *This article's main focus is on creating a completely improved IA distribution controlling system that uses the Arduino program and extends Industry 4.0 by utilizing IOT and wireless sensor interfaces, emulating the Arduino IAD plant, and making it accessible online for remote control. Particularly in tropical countries like India, air conditioners have become a necessary element of daily life. An air conditioner is regarded as one of the most important control variables in a construction. This project is all about using voice commands to operate an air conditioner. Here, the Michel C. JARVIS application is used to recognize voice instructions and turn on/off an air conditioner. The ARDUINO voice sensors will enable the air conditioner to comprehend spoken commands and control the compressor.*

Key Words: **Internet of things (IoT), Industry 4.0 , Instrument air (IA)compressor, IA Distribution system, and Arduino**

1.INTRODUCTION

In general, a pneumatic power supply is required for pneumatic components to function in any plant that has a large number of them. These pneumatic supplies are created and distributed by a distinct system known as the Instrument air distribution system. The pneumatic control valves need air, which instrument air supplies. Three Instrument Air Compressors (IAC) make up the Instrument Air Distribution system of a thermal power plant, which is triggered in response to the demand for instrument air. The compressor is now controlled by relay logic. Relays are electromechanical devices that use an electrical signal to turn on a mechanical switch. Applying control logic to relays requires complex wiring. Future changes will be more challenging to implement as a result. Maintenance is time-consuming and challenging; improper wiring could lead to errors and even accidents. It is extremely challenging to diagnose and fix.

2. OVERVIEW OF EXISTING SYSTEM

Hard-wired controller implementation is an obsolete method that loses reliability with time. The on-site Human Machine Interface (HMI) is difficult to see. To solve these issues, To act as the local controller, a PLC is used. In Ladder Logic constructed for it, and it is verified using the CoDeSys3 visualization tool. The IA compressor and IA distribution system have been simulated as virtual instruments with their respective control logic in the LabVIEW environment to evaluate the operation of control logic and serve as HMI. Additionally, the IA distribution system has adopted Industry 4.0 using the Internet of Things (IoT).

3. DESIGN OF PROPOSED SYSTEM

IAD system control system diagram is shown in Figure 1. The controller exercises the necessary control. the use of Arduino to automate the air distribution system. There are two types of instrument air controllers. Automatic start and stop controller (ASSC) is the first, while continuous supply controller is the second (CSC). The supply is quantitatively divided into two bands in ASSC mode: a band that is 100% ON and a band that is 0% ON or OFF. The 100% switch will turn in this mode, while the other switches are off when the process point is less than or equal to the specified point. The switch will reset when the process point is greater than or equal to the set point. The Continuous Supply Controller is second (CSC). Three bands—100% ON, 50% ON, and 0% ON or OFF band—are quantitatively separated from the supply in CSC mode. The PP is lower than SP in this mode. When PP reaches or equals SP, the 50% switch turns on and the other switches go off. When PP exceeds SP, the 0% switch turns on and the other switches are reset.

As a virtual instrument, the compressor plant's dynamics are simulated, Arduino is used to collect current data (as a DAQ), & indicators are used to show the condition of various final-control elements. The LabVIEW web publishing tool is used for remote HMI packages; it serves as a front panel of the complete procedure may be published on the internet thanks to a webserver.

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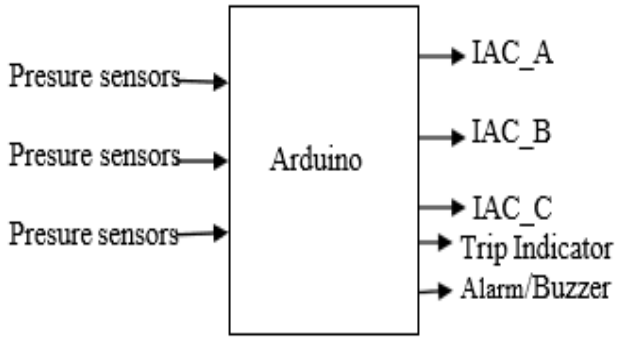

Fig-1. Instrument Air Distribution Control System

3.1 OBJECTIVES

Below mentioned is main objective of this project.

- To create a fully updated IA distribution control system with Lab view and Arduino.
- In addition, industry 4.0 is implemented by using Lab view as the HMI, simulating the IAD plant in Arduino, and publishing the same content online for remote access.

3.2 Working Principle of Module's.

(i) INSTRUMENT AIR COMPRESSOR:

Instrument air compressors and service air compressors are the two types of compressors utilized in the facility. Service air is produced by service air compressors, whereas instrument air is produced by instrument air compressors. The drier mechanism for removing moisture from the air is the primary distinction between the distribution systems of interior air and service air.

(ii) INSTRUMENT AIR CONTROLLER:

There are mainly two types of IA controllers:

- Automatic start and stop controller (ASSC)
- Continuous supply controller (CSC)

The fundamental concept of the two controllers is the ONOFF controller. They differ significantly in terms of Band supply and the time-out for unloading feature.

4. Experimental Setup and Results.

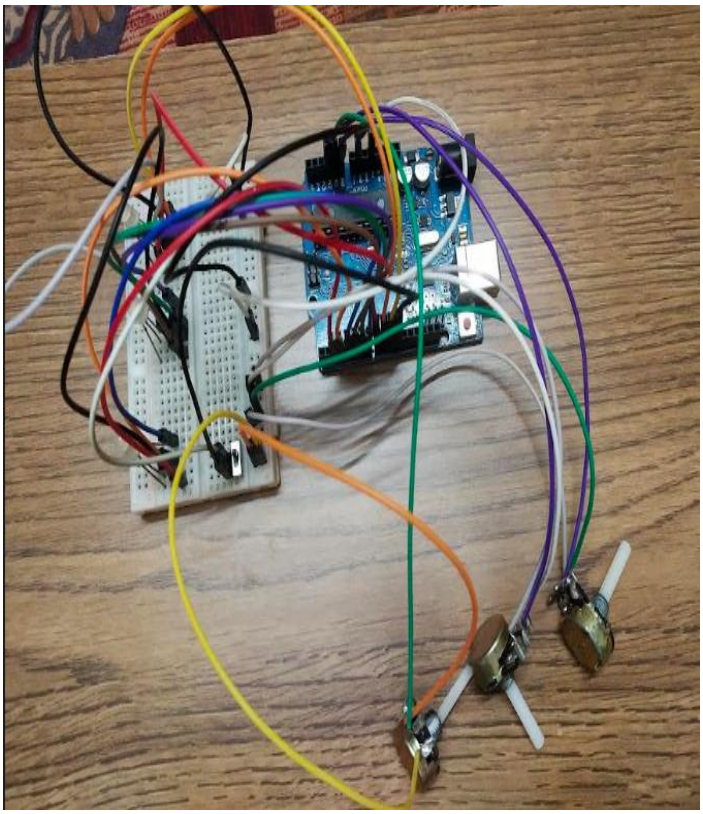

Fig-2. Experimental Setup.

The Above Diagram is Experimental Setup for Utilizing Arduino and Industry 4.0 to automate the instrument air distribution system Currently, exhibiting results for the Automatic Start and Stop Controller and Continuous Supply Controller marks 50% of the project's completion. The supply is quantitatively divided into two bands in ASSC mode: a band that is 100% ON and a band that is 0% ON or OFF. When the process point is less than or equal to the desired point in this mode, the 100% switch will turn on while the other switches remain off. The switch will reset when the process point is greater than or equal to the set point. The supply in CSC mode is quantitatively divided into three bands: 100% ON, 50% ON, and 0% ON or OFF band. When PP is less than SP in this mode, the 100% switch is on and all other switches are off; when PP reaches or equals SP, the 50% switch is on and all other switches are off; and when PP exceeds SP, the 0% switch is on and all other switches are reset.

4.1 Results for Automatic start and stop controller (ASSC).

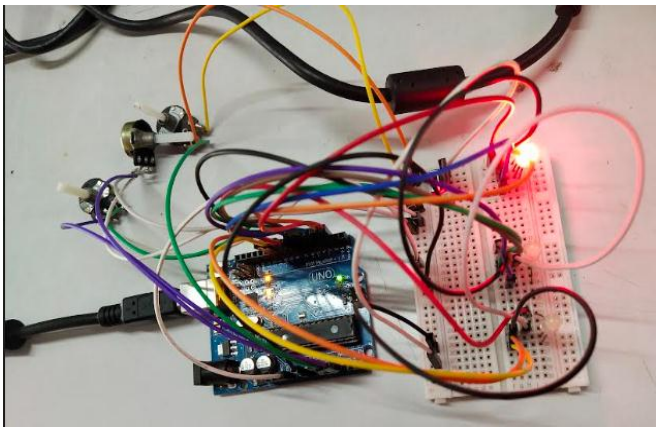

Fig-3 When process point is greater than or Equal to set point

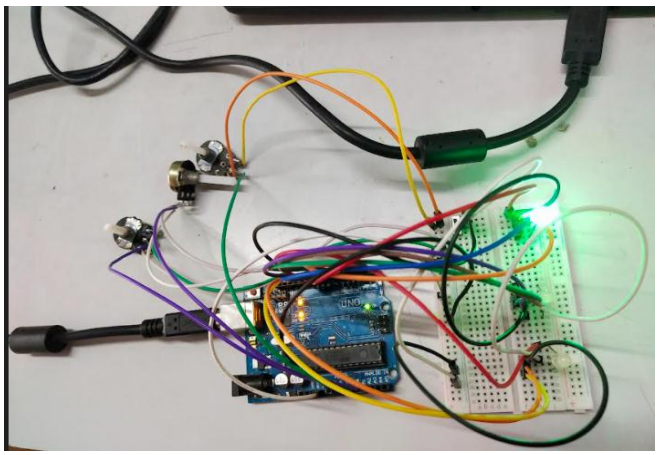

Fig-4 When process point is less than or Equal to set point

4.2 Results for Continuous Supply controller (CSC).

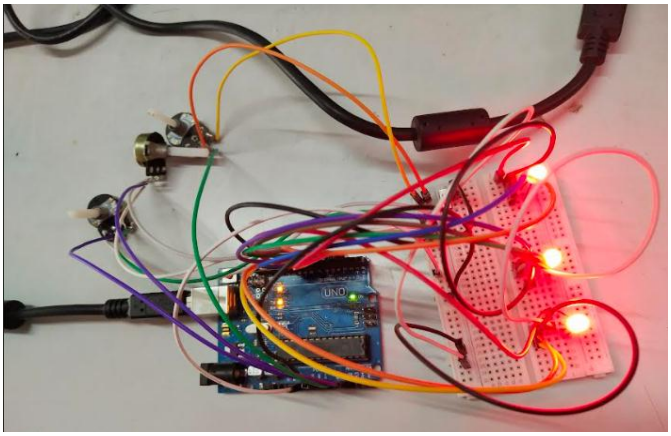

Fig-5 Initial Status

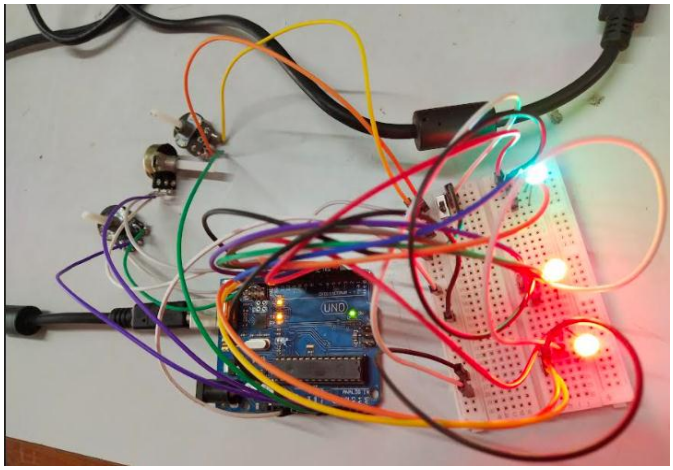

Fig-6 When process point is less than set point

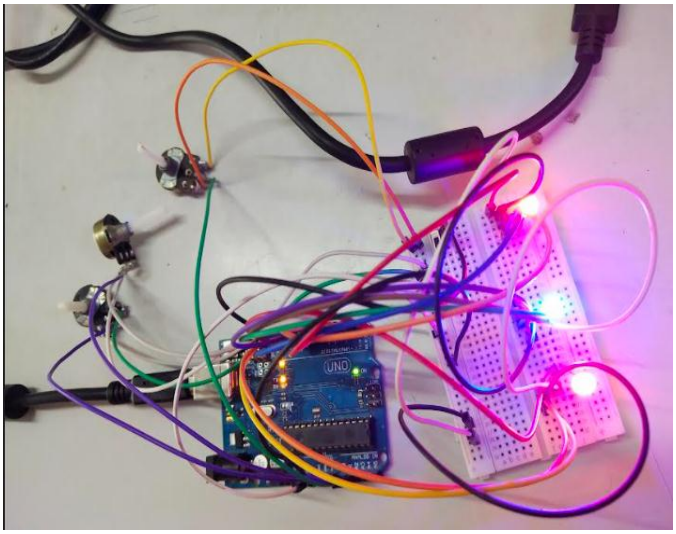

Fig-7 When process point is equal to set point

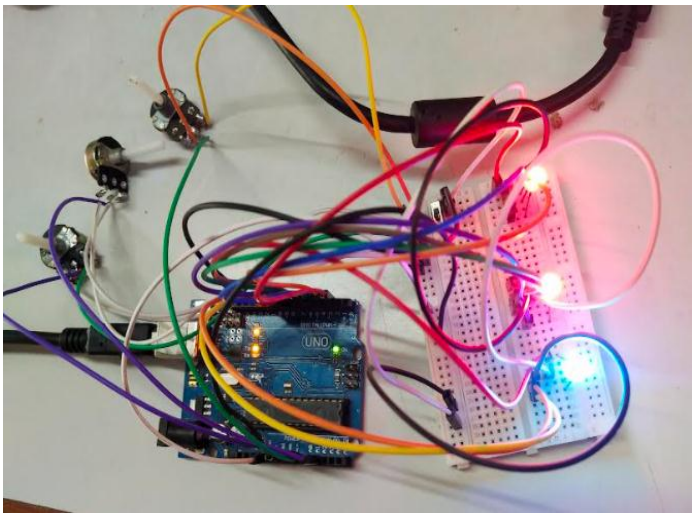

Fig-8 When process point is greater than set point

5. CONCLUSIONS

The entire instrument air compressor system is managed by the Arduino. Real-time data is fed into Arduino. Utilizing a web publishing tool is an example of Industry 4.0. This suggests wireless communication and cloud-based data storage, which negates the requirement for a substantial, intricate system.

6. ACKNOWLEDGEMENT

The researchers value their colleagues' insightful discussions and feedback on the topics covered above.

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