Development of Design of Pneumatic Circuits using Arduino Microcontroller

V. K. Rajendran
Lecturer (Sr. Grade)
Department of Mechanical Engineering
AMK Technological Polytechnic College, Sembarambakkam, India

A. Chockalingam
Draughting Officer (S Selection Grade)
Department of Machinetool Maintenance & Repairs
AMK Technological Polytechnic College, Sembarambakkam, India

Abstract

Programmable logic controllers are used in industry in many areas of automation and technology as well as for control and regulation tasks. A PLC is a device with specialized input and output interfaces. These interfaces (sensors and actuators) to regulate, controls and monitors the manufacturing processes. While designing pneumatic circuit's more than one cylinder using cascade circuits or KV design in basic pneumatics and electrical relays with timer and counter circuits in electro pneumatics is complicated and using limited cylinders only. Thus the complicated circuits using more number of cylinders can easily be implemented by programming using any kind of PLC or Arduino microcontroller .When comparing the cost of Arduino microcontroller ten times less than the PLC unit. Moreover interfacing devices of input sensors are easily adoptable one with low cost and can be interfaced to any kind of output environment like OLED display, Bluetooth, WIFI control and I O T control system.

Keywords: Arduino Controller, Digital & Analog Sensors, Pneumatic Circuit Design

I. INTRODUCTION

The machines are getting more and more complicated, industries won't be able to do without PLC programs. It is even possible to program and control PLCs via data radio communication or radio relay system. It is also possible to write PLC programs, implement error detection and correct errors via remote maintenance. In order to face the today's Industrial automation, machine vision and robotics with artificial intelligence technology control system requires most advanced controller device technology to meet today and future technology.

Fig. 1:

The "maker" world of basement robot builders continues to grow, with companies developing hardware and software to support all sorts of interesting applications. A number of micro-controllers have emerged to perform a wide variety of functions at very low upfront hardware and software costs.

A large number of boards, including micro-controllers, field programmable gate arrays (FPGAs) and single-board computers, have emerged. Among these, Arduino and Raspberry Pi are two leading names (Figure 1). Both are open-source devices; with components available from a variety of suppliers, and both require a high level of programming skills and some imagination before they can be used for real-time industrial control applications.

Arduino is a collection of three things. There are Hardware prototype platform, Arduino language and IDE & libraries. The Arduino boards are micro-controllers, not a full-fledged computer. They don't run a full operating system, but simply write the code and execute as their firmware interprets it. The main purpose of the Arduino board is to interface with the devices and sensors, so it's great for hardware projects in which you simply want things to respond various sensor readings and manual input. This may not seem to be a lot, but it is actually a very sophisticated system that allows you to better manage your devices. It is great for interfacing with other devices and actuators, where a full operating system would be overload for handling simple read and response actions. It has 8-bit AVR microcontroller and hardware support for SPI, I2C and Serial.

II. ADVANTAGES

Following are some of the main advantages of Arduino controller.

- Very easy to get started.
- Can be used for real-time applications for hardware, software and IDE is open source.
- Not much programming knowledge needed to do basic stuff.
- It is very easy to extend and has tons of user contributed shields and libraries. Shields are available to do attractive much anything.

III. EXPERIMENTAL WORK

In this experimental work, there are controlled 4 pneumatic cylinders via 4 coils. Every pneumatic cylinder has got their own coil which switch air to the pneumatic cylinder. Every pneumatic cylinder has got 2 magnetic sensors (when the pneumatic cylinder is retracted and extended). To activate the 12VDC solenoid coil, we are using the Arduino IDE, this is available from https://www.arduino.cc/en/Main/Software. Readily available interfacing driver card which is used to connect the 5VDC signal from the arduino controller to 12VDC power supply for the solenoid valves.

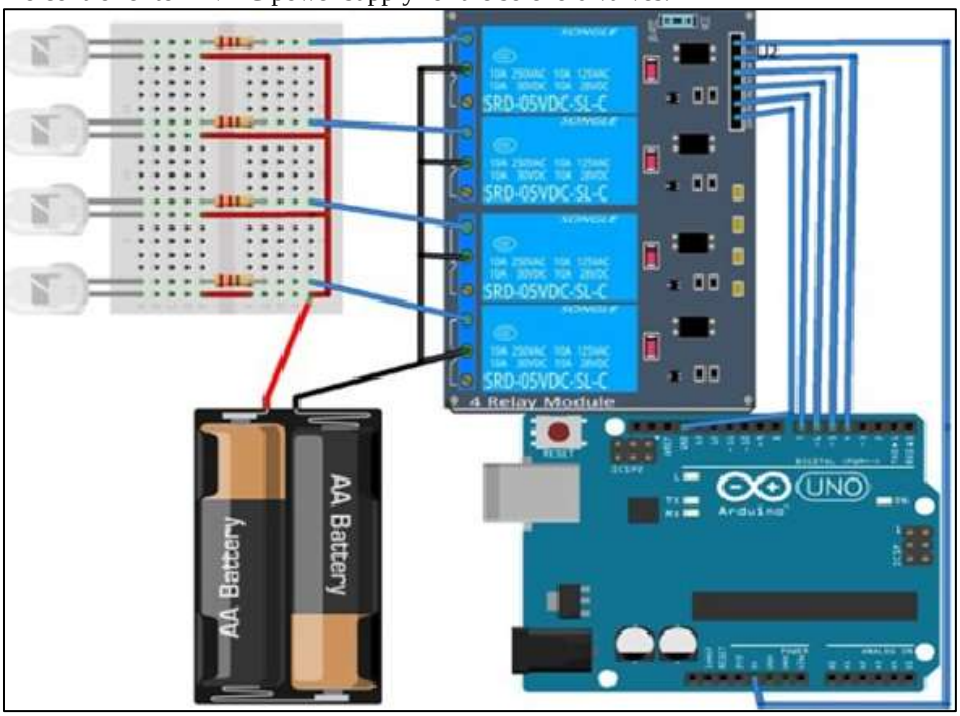
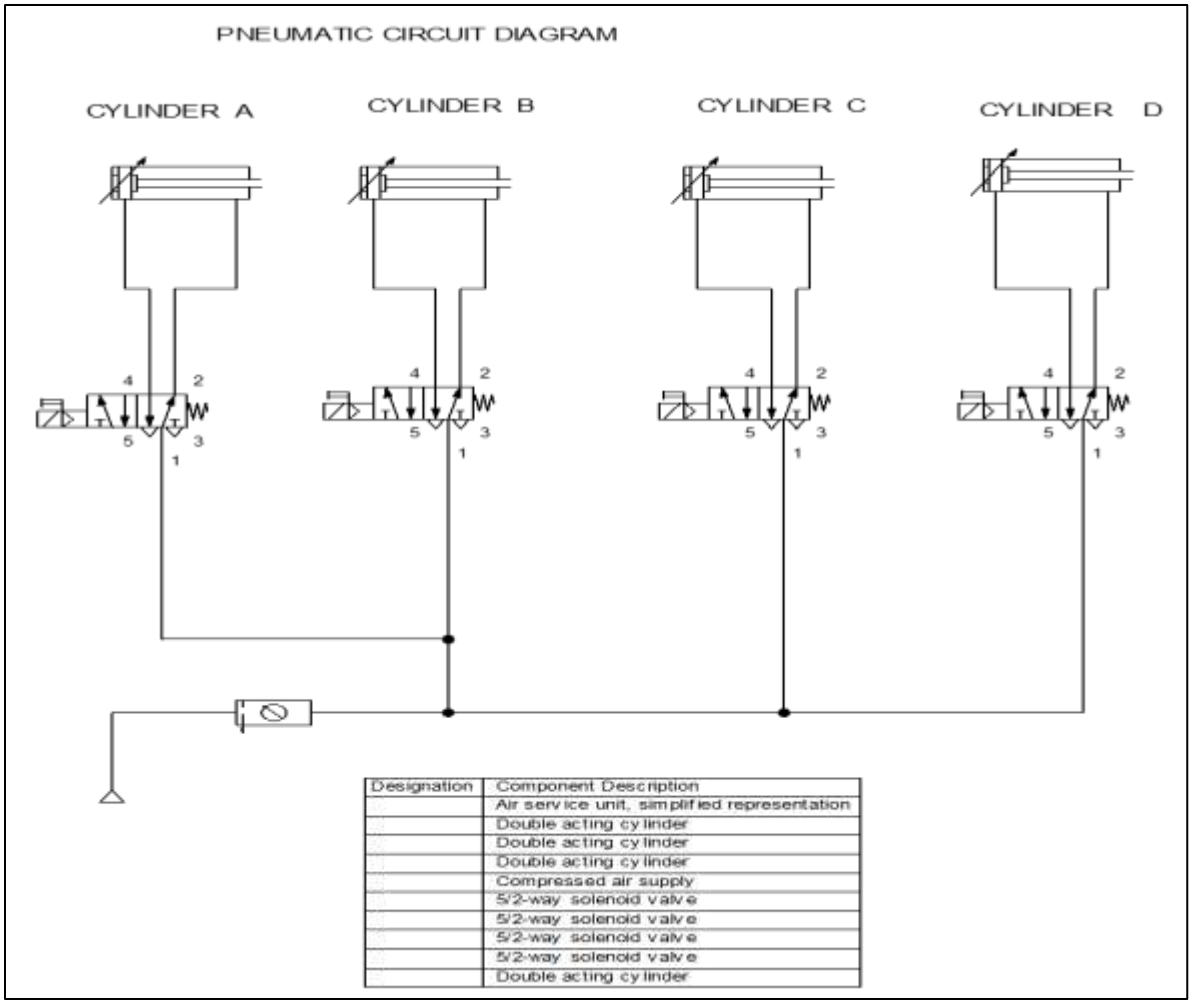


Fig. 2:

The controller was programmed to meet our design of sequential cylinder movements. Now that all of the code has been written it can be uploaded to Arduino IDE software. Click "Upload" button in the top left corner of the Arduino IDE and it should upload without any issues. After a few seconds the solenoid will start opening and closing.
Thus wiring circuit for 4 relays connected to solenoid valves as shown in below.

IV. PNEUMATIC CIRCUIT DESIGN



Designation	Component Description
	Air service unit, simplified representation
	Double acting cylinder
	Double acting cylinder
	Double acting cylinder
	Compressed air supply
	5/2-way solenoid valve
	5/2-way solenoid valve
	5/2-way solenoid valve
	5/2-way solenoid valve
	Double acting cylinder

Fig. 3:

V. CONCLUSION

Thus pneumatic sequential logic circuits were designed used for industrial automation are presented and implemented with a fabricated kit. Basic of the ARDUINO controller is briefly descried in this circuit design. The programming codes are to be followed in developing this logical sequences of cylinder movements are then presented.

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