

Stepper Motor Control using ARDUINO ATMEGA - 328 Micro-Controller

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Abstract— In this paper, we are going to rotate a stepper motor by using an arduino microcontroller. Arduino has been programmed in order to rotate the stepper motor for various applications. The motor drive which acts as an interface between the arduino board and the stepper motor. The arduino board is being triggered manually by applying the external voltage of about 5V. From this it can be directly deliver the input to the stepper motor drive where it provides sufficient current to the stepper motor which tends to rotate the stepper motor. By programming the stepper drive, we can be able to control the speed of the stepper motor, direction of the stepper motor either in clockwise or an anti-clockwise direction. Motor drive protects the stepper motor from damages so that the stepper motor drive can be connected in between the stepper motor to the arduino board.

Key words: ARDUINO ATMEGA – 328 Micro-Controller, Stepper Motor Control

I. INTRODUCTION

There are various ATMEGA microcontroller used for many applications. In this paper, we are going to use ATMEGA 328 arduino microcontroller. ATMEGA 328 microcontroller has different numbers of analog and digital inputs. A specially provided USB cable which acts as an interface between the micro controller and the computer. From the USB cable, we upload the program to the microcontroller. Based on the program done in the microcontroller, we can use the microcontroller for various applications such as rotating and to control the speed of the motor.

ATMEGA 328 microcontroller consists of 6 analog inputs (A0 to A5) and 13 digital inputs. Power supply pins and ground pins are used for the power supply of the component. Analog inputs are used to trigger the circuit manually. But majority of the applications works on digital input of the circuit. The stepper motor is being connected with the digital input of the circuit. Reset button is provided in the microcontroller board to reset the program and also to upload the other program.

Stepper motor drive acts as an interface between the microcontroller and the stepper motor. If the microcontroller and the stepper motor are connected directly, the circuit gets damage because of the inefficient power supply. Stepper motor requires a specific voltage to rotate in clockwise or counter clockwise direction. The role of stepper motor drive is to provide a sufficient input signal to the stepper motor by obtaining an input from the microcontroller. Various motor drives are used to drive various kinds of motors. Stepper motor drive is particularly used in order to obtain the desired output without any damages to the component.

Stepper motor can be varied from a normal motor only from stepwise rotation. Different kinds of stepper motors are used for step wise rotation for various

applications. But based on the biomedical project, we are using a small type stepper motor with the range of 5V power supply. Stepper motor can be used only for the application based on stepwise rotation. Direction of the motor can be controlled by using the microcontroller. These 4 wired stepper motor which has 2 north poles and 2 south poles. Based on triggering the circuit, the motor can be rotated either in clock wise or counter clock wise direction. The motor can be rotated by connecting the motor with the microcontroller.

ATMEGA microcontroller has been connected with the stepper motor drive circuit by using the jumper cables. The input and the power supply are connected with the microcontroller. The digital input of the microcontroller is connected with the stepper motor drive for the efficient input deliver to the motor. The 4 wires present in the stepper motor are connected with the motor drive according to the input of the system. Arduino programming is done by using the arduino software and the program is uploaded in the microcontroller. Arduino microcontroller is connected with the stepper motor drive. Followed by the stepper motor drive, stepper motor is connected. When the input signal is given either by manually or by triggering the circuit, microcontroller fed the input to the stepper motor drive. The stepper motor drive which in turn amplifies the signal and therefore it sends the amplified signal to the stepper motor. Stepper motor is rotated according to the program developed in the arduino software. The rotation, speed, direction of the motor can be controlled by using arduino software.

II. HARDWARE DESCRIPTION

A. ARDUINO ATMEGA - 328 Microcontroller:

The ATMEGA-328 Microcontroller has the features as High performance, Low power AVR 8-bit microcontroller. The microcontroller works on the operating temperature range as -40oC to 85oC, the operating voltage of microcontroller is of about 1.8 to 5.5 V, the speed grade will be in the range 0-20 MHz. The peripheral features of microcontroller that it has six PWM channels and it has a real time counter with separate oscillator. The advanced RISC architecture has the feature in which it has a fully static operation. It has the feature in which it has the programming lock for software security.



Fig. 1: ARDUINO ATMEGA 328 Microcontroller

B. Stepper Motor Drive:

Stepper motor drive is used to rotate the stepper motor with particular input and also it protects the motor from the back Emf. It amplifies the input provided by the microcontroller and further it passes the amplified signal to the stepper motor. It provides the sufficient signal to drive the stepper motor. It acts as an interface between the arduino microcontrollers to the stepper motor.

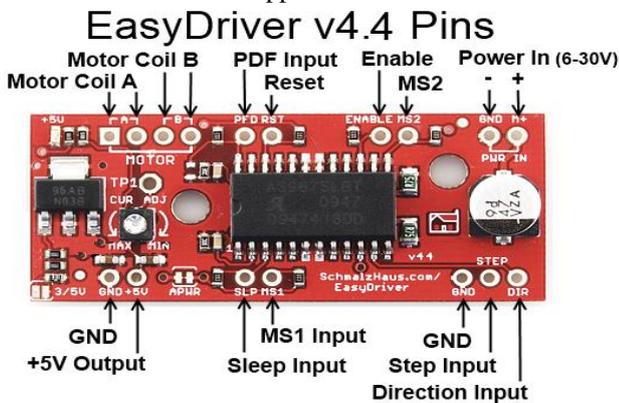


Fig. 2: Stepper Motor Drive

C. Stepper Motor:

There are different types of stepper motor such as unipolar and bipolar stepper motor. It is a four wired stepper motor. It rotates in a stepwise manner. Each two wires represent the north and south poles of a magnet. It consist of two elements namely stator and rotor. Stator represents the magnets in stationary movement and the rotor which represents the magnets in rotatory movement. Stationary part of the magnet can be wounded with the coil. When the copper coil receives the current supply, the magnet gets energised and then it acts like a magnet. By applying the power supply in the circuit, the rotor may rotate either in forward or in a reverse direction. The speed of the stepper motor can be controlled by arduino microcontroller. By varying the program parameters, the speed, torque and the direction of the stepper motor can be controlled. These stepper motor can be used for many industrial applications and also for the general purpose applications.



Fig. 3: Stepper Motor

III. SOFTWARE DESCRIPTION

Arduino has been programmed to rotate the stepper motor by using the arduino software. These programming can be used to control the speed and direction of the motor. The program that is used to rotate the stepper motor is given below.

```

/*
Stepper Motor Control - one revolution
This program drives a unipolar or bipolar stepper motor.
The motor is attached to digital pins 8 - 11 of the Arduino.
The motor should revolve one revolution in one direction,
then one revolution in the other direction.
*/
#include <Stepper.h>
const int stepsPerRevolution = 200; // change this to fit the
number of steps per revolution
// for your motor
// initialize the stepper library on pins 8 through 11:
Stepper myStepper(stepsPerRevolution, 8,9,10,11);
void setup() {
// set the speed at 60 rpm:
myStepper.setSpeed(60);
// initialize the serial port:
Serial.begin(9600);
}
void loop() {
// step one revolution in one direction:
Serial.println("clockwise");
myStepper.step(stepsPerRevolution);
delay(500);
// step one revolution in the other direction:
Serial.println("counterclockwise");
myStepper.step(-stepsPerRevolution);
delay(500);
}

```

IV. IMPLEMENTATION

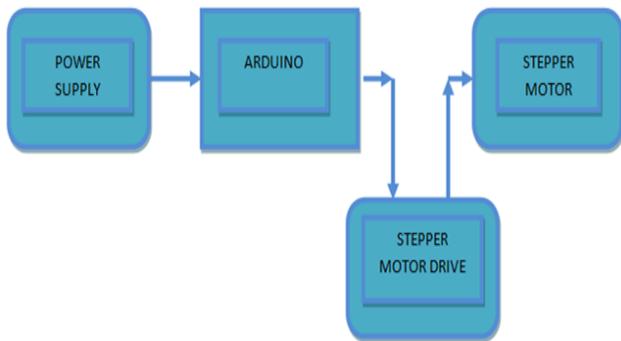


Fig. 4: Implementation

A. Execution:

According to the circuit, the connections are done by connecting the stepper motor with the arduino microcontroller interfaced by the stepper motor drive. Input and the output connections are properly done and therefore the connections are to be made easier by connecting using jumper cables. Program has been uploaded in the microcontroller. The power supply of the circuit is connected. When the ground pin and 5V pin is connected with the motor manually, the arduino board gets triggered and further it sends the signal to the stepper motor drive. The stepper motor drive which amplifies the signal and send to the stepper motor. The stepper motor receives the proper current and voltage and therefore the stepper motor can be rotated easily. By editing the program, the speed and direction of the stepper motor can be controlled.

By supplying 5-12VDC to power the motor. There are two ways to do this

- It can power the Arduino via the DC Barrel Jack and insert the VIN Jumper shown as the tall black handle right next to the green Power LED below
- It can power the Arduino via the DC Barrel jack or USB port. Then Power the shield via the 5-12VDC motor power terminal port, the double terminal block next to the green Power LED and remove the VIN jumper.

V. CONCLUSION

In general, the stepper motor can be rotated directly by connecting the motor with the power supply. But by creating an arduino program where the stepper motor can be rotated by using the ATMEGA microcontroller. The speed and the rotary directions can be controlled by editing the arduino program. These arduino programming stepper motors can be mainly applicable in the industries for the automation process. Generally stepper motors can be used for various applications. But by programming and rotating the stepper motor, it can be applicable for automation process in the industries.

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