A Research paper on High Stepper Speed Control PC-Based Motor Using Wired Communication

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Abstract

Stepper motors are utilised in a wide variety of devices and home appliances that are commonplace in contemporary culture. Sensing variables for the purpose of control, such as location, velocity, or current, is an issue that occurs frequently in many different industrial driving applications. It may be difficult to sense signals that accurately describe system variables, such as the absolute shaft position, due to the high cost involved or the constraints imposed by the physical environment. In situations like these, we are forced to make estimates for all or some of the missing variables based on a small number of data that may be subject to noise. The stepper motor will be controlled through keypad, and the goal of this project is to strategy and build a circuit that uses a microcontroller to accomplish that task. Because of this, the circuit of the microcontroller is able to control the stepper motor's speed as well as the step angle. Whenever the user enters a variety of commands using the keypad. This project explains in detail how to interface a high-voltage electrical device or a direct current/alternating current motor with a personal computer system that is very sensitive. Using the technology that has been established, we will be able to develop the graphical user interface that will monitor and control the speed of the stepper motor. The undertaking can be broken down into its two component parts, which are the hardware and the software. The proposed system's hardware, as well as the means by which it will interface with a computer by way of an RS232 serial connection port. Between the PC and the controller, we are establishing communication over an RS-232 connection.

Keywords
High stepper Motor, R$232, PC, MAX 232

I. Introduction

The stepper motor was developed to satisfy a specific need in the field of motor control. Applications involving measurement and control make the most frequent use of these motors. Inkjet printers, CNC machines, and volumetric pumps are some examples of possible uses. Stepper motors, in general, share a number of characteristics that make them particularly well-suited to the kinds of uses described below. Brushless motors are used in stepper motors. The commutator and brushes of a traditional motor are some of the components with the highest failure rates, and they are also responsible for the creation of electrical arcs, which can be undesired or even hazardous in some settings. As long as the load does not exceed the torque rating of the motor, the Stepper motor will not turn at a speed regardless of the amount of resistance it is experiencing from the load. Stepper motors' open-loop positions move in defined increments of steps when the motors are operating. The holding torque characteristic has the ability to keep the shaft in its current position. Stepper motors are available in a wide range of sizes and strengths, from the motors used in floppy discs to those found in massive machines. Controlling the stepper motor drive's duty cycle is accomplished by utilising the Pulse-Width-Modulation (PWM) function found within the microcontroller. PWM is a whole different method to control the speed of a stepper motor than is traditionally used. A square wave with a constant voltage but variable pulse width or duty cycle is what the motor receives for its supply of electrical power. The term "duty cycle" refers to the proportion of a single cycle that occurs within the duty cycle of a continuously occurring train of pulses. A low duty cycle corresponds to low power since the power is off for the majority of the time when the duty cycle is low. The word "duty cycle" refers to the proportion of "on" time to the regular interval or "period of time." The duty cycle is given as a percentage, with 100 percent indicating that the device is completely operational.[1][2]

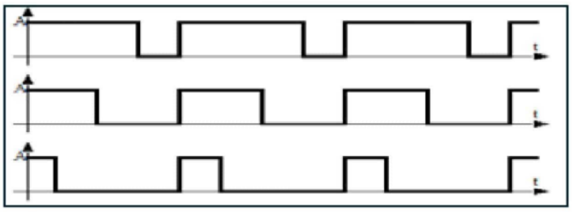

Fig. 1: Wave form at Different Duty Cycles

II. Hardware Development

The following illustrates, in block diagram form, the proposed system:

A. Modules for the Power Supply

This module's primary purpose is to deliver 5 volts at a current of 500 milliamps. This consists of a transformer, which is used to step down the AC voltage, IN4007 diodes, which are used to form a bridge rectifier in order to convert AC to DC, a capacitor of 1000uF, which is used as a filter circuit, 7805 regulators, which are used to obtain 5V at the output of the regulator, 330-ohm resistance, and an LED as an indicator.

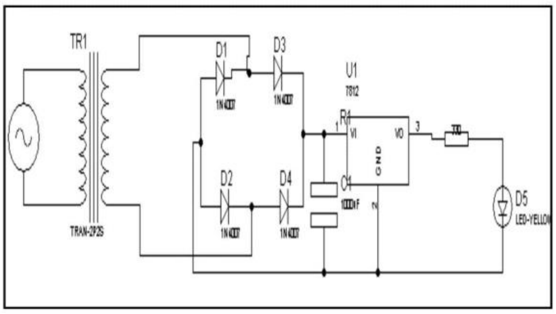

Fig. 2: Diagram of Supply Section

B. Microcontroller (ATmega16)

Microcontrollers are widely available. Due to its built-in ADC interface and variable frequency, the ATMEGA16 from the AVR series was chosen for this project. AT megal6, a low-power CMOS 8-bit microcontroller, uses AVR RISC architecture. The ATmegal6 executes powerful instructions in a single clock cycle to achieve high throughput. This allows the system to optimise power usage and processing performance. It also reduces LAN costs. [3]

C. Model C USB-to-serial cable

This node interfaces with the coordination node and other nodes.

D. (level converter IC)

The MAX232 dual driver/receiver IC produces ElA-232 voltage levels from a single source via a capacitive voltage generator.

5 V. Each receiver converts ElA-232 to 5 V TTL or CMOS. Receivers have a 1.3 V threshold. 0.5 V hysteresis, 30 V inputs. Each driver converts TTL/CMOS to EIA-232. We should be able to get this functioning with a few capacitors.

E. Liquid Crystal Display:

The LCD (liquid crystal display) device accepts 8-bit character codes from a microprocessor or microcomputer, latches them to its display data RAM (80-byte) DD RAM for storing 80 characters, and then displays the characters on its LCD screen. Liquid crystal display (LCD) We are 16x2 LCDs and have 16 hardware pins. Pins 1, 3, and 16 are grounded, pins 2 and 15 are +5v, pins 3, 4, and enable are RS, RW, and enable, and the enable pin is always low. Display uses LCD data pins 11,12,13,14 for parallel four-bit transmission. [4]

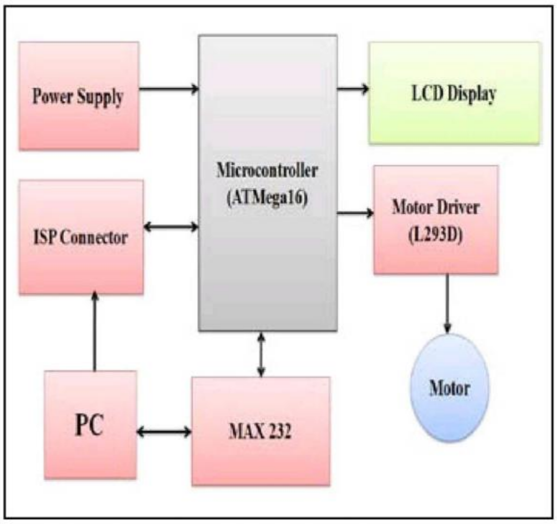

Fig. 2: Block Diagram of System

F. DB9

The connector has 9 male and 9 female pins. In DB9, the number 9 refers to the total number of pins, and the letter D refers to the two rows of pins that are parallel to one another and are shaped like the alphabet.

G. L293D (Motor Driver IC)

This integrated circuit is a high-voltage, high-current, four-channel driver that is designed to take DTL or TTL logic. This has the capability of delivering an output current of 600 mA per channel, as well as providing 1.2 peak output current (non repetitively) per channel, and it also has built-in safety against internal overheating. It is made up of a Half H Bridge, which allows for a large current to be supplied in order to drive motors.[5]

H.RS-232

An RS-232 port was originally a common component of a personal computer, and it served as a connection point for various peripheral devices such as modems, printers, mouse, and data storage devices. The PC and the controller will communicate with one another using RS-232 cables.[6]

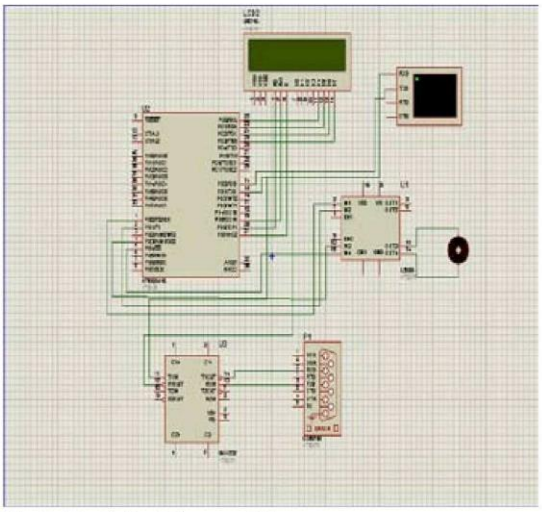

Fig. 3: Simulation Diagram of System

III. Software Development

Microcontroller, when it is used to operate as a wireless network involves following steps:

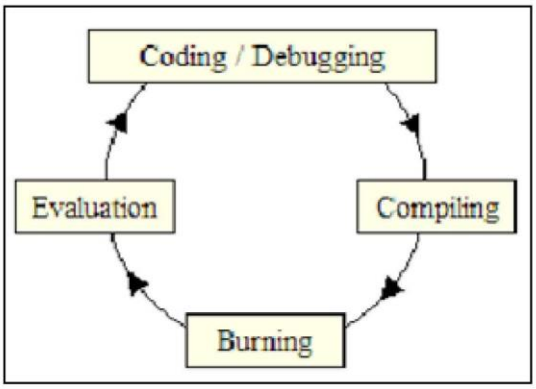

Fig. 4: Steps for Software Development

1. Coding/ Debugging

In a high-level language, coding and debugging are essentially the same thing (such as c or java). The use of a compiler for a high-level language helps to shorten the amount of time needed for production. C was the programming language of choice when utilising WinAVR [2] to write programmes for the microcontrollers. The source code has been commented in order to make any potential future maintenance and enhancements more manageable. WinAVR is a collection of open source software development tools that are executable and are hosted on the Windows operating system. These tools are designed for use with the Atmel AVR series of RISC microprocessors. It comes with the GNU GCC compiler, which may be used for both C and C++. WinAVR incorporates all of the necessary tools for coding on the AVR platform. This consists of things like the AVR-gce compiler and the AVR-gdb debugger, among other things.

2. Compiling

Following the compilation of the programme, the code is then transformed into a machine-level language consisting of 0s and 1s. This file, which is saved with the extension. Hex, is referred to as the Hex file (Hex). In addition, the compiler will cause mistakes to be produced in the programme, which will need to be fixed before the programme can be run correctly.[6]

3. Burning

Using a specific programmer that connects to the peripheral of a personal computer (PC), it is possible to write the machine language (hex) file directly into the programme memory of the microcontroller. The serial port on the personal computer has been utilised for this purpose. In order to accomplish this goal, the Ponyprog programmer was utilised to write the machine language file into the programme memory of the microcontroller. Pony prog is a piece of serial device programming software that runs on Windows 95/98/ME/NT/2000/XP as well as Intel Linux. It features an intuitive graphical user interface. Its function is to read and write data from and to all serial devices. It is compatible with the Atmel AVR and Microchip PIC microcontrollers, as well as the I'C Bus and Micro wire communication protocols. Using a high speed-programming mode, the microcontrollers were each programmed in about two seconds' time. The programme memory is of the Flash kind, and just like the EEPROM, it has a certain amount of time that it may be used. Atmega16 Programmer (ISP), which is used to burn the programme into AVR microcontrollers, allows it to be reprogrammed an unlimited number of times on AVR microcontroller family without the risk of data damage. This can be done up to a thousand times.

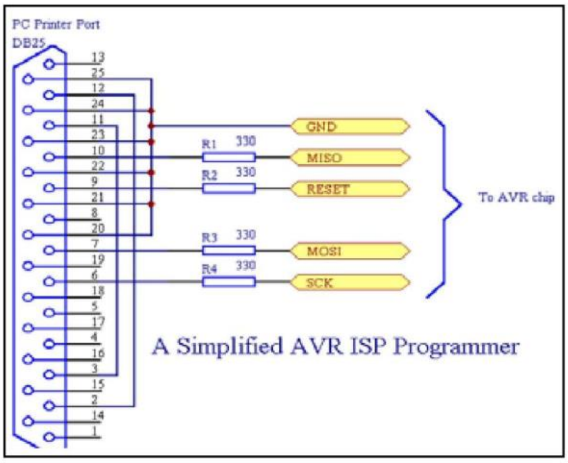

Fig. 5: Snapshot of Robokits AVR Programmer Window to Erase, Write and Verify .h File Generated by AVRstudio4 to Target

4. Assessment

If the system functions as required by the user and all jobs efficiently and effectively, the software development process is over and the project is ready to be installed as a LAN. If errors occur, the process is repeated. Microcontroller programming is difficult because of restricted resources. Unlike microcontrollers, PCs have limitless RAM and processing speed.

Microcontroller code should be as resource-efficient as feasible, but it should also be cost- and power-efficient. The system's programming. Uses.c and.h files.

5. ICD.C

This c file controls the LCD module. Code controls LCD initialization, data writing, cursor movement, attributes, and location. It allows character-by-character or string-by-string LCD data entry. The software is based on the LCD's Hitachi HD44780 IC command set. Initlcd(), remove(), display(), displayint are in this file ().

Programming functions

The controller's code includes:

I programme delay

Void delay (unsigned char value) _delay ms(1);

Motor control

Motor dead (char data)

{

Switch(data)

Case 'a':

motor at 100%;

Break;

Case 'b':

motor at 75%;

Break;

Case 'c': motor at 50%;

Break;

Case 'd':

motor at 25%;

Break;

Break; motor at 0%

}

CONCLUSION

Stepper motors are utilised in industrial, office, medical, and automotive applications. This study successfully designed a system to control the speed of a Stepper Motor through a PC due to its simplicity, low cost, high dependability, and ability to be controlled in an open-loop system. The study advances industrial stepper motor utilisation.

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