

Wireless Speed Control of Dc Motor using PWM and UART

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Abstract: The main objective of the proposed system is to develop an embedded system which can control the duty cycle of the PWM (Pulse width modulation) signal which will change the speed of the industrial motor via wireless communication. Bluetooth is used to send the control commands to the proposed system with the help of UART (Universal asynchronous receiver transmitter). One of the main tasks is to control the speed of motor according to their need. Normally people use to change the speed using resistance based or power electronics based regulators but the proposed system is changing the duty cycle of the PWM signal to accurately control the speed of the motor. Proposed system suggest the controlling of motor speed using modern devices like android based smart phones, tablets, laptops etc by sending the percentage of duty cycle as a command. Handshaking (two way communication) is also introduced to make the system user friendly. This modernized the way of working in industry.

Keywords: UART(Universal asynchronous receiver transmitter), PWM(pulse width modulation), Duty Cycle, Bluetooth module(HC05), MCU(Microcontroller Unit), ISIS(Intelligent Schematic Input System), CVAVR(Code Vision AVR), VSM(Virtual System Modelling).

I. INTRODUCTION

This project has the main motto of being user friendly interface and high accuracy for controlling the speed of the dc motor with ease as it is controlled wirelessly and running it according to the need of the user.

The project is built on microcontroller which serves as the main interfacing unit of the system. User has to connect to the Bluetooth with their smart phone. They just need to enter the duty cycle required by them, this is sent to the micro controller by the Bluetooth module (HC05) which receives the value from the application they are using through virtual terminal. Then the micro controller sends the value to the PWM system and duty cycles is set and the motor speed is controlled.

MCU is main part which establishes connections between Bluetooth and the motor with its internal processing of data. HC05 modules uses Bluetooth SPP module, designed for transparent wireless serial connection setup.HC05 can be used in master/slave connection. User has a range of 10 feet within which the system can be controlled.

II. THEORY

A universal asynchronous receive/transmit (UART) is an integrated circuit which place the most important role in serial communication. It handles the conversion between serial and parallel data. Data is sent serially as it reduces the distortion of the signal and data transfer is improved. It contains the parallel to serial converter for data transmitted from the computer and serial to parallel converter for data coming in via serial line. The UART also has a buffer for temporarily storing the data from high speed transmission.

In addition UART will usually provide additional circuits for signals that can be used to indicate the state of the transmission media and to regulate the flow of data in the event .that the remote device is not prepared to accept more data.

The UART receiver module is used to receive the serial signals at RXD and convert them into parallel data. The UART transmitter module converts the bytes into serial bits according to the basic frame format and transmits those bits through TXD [1].

Pulse width modulation is a modulation technique used in most communication system for encoding the amplitude of the signal right into a pulse width or duration of another signal, usually a carrier signal for transmission.

It is used to controlling the amplitude of digital signals in order to control devices and application requiring power or electricity as shown in figure 1. It essentially controls the amount of power, in the prospective of the voltage component, which is given to the device by cycling the on-and-off phases of a digital signal quickly and varying the width of the “on” phase or duty cycle. Through PWM a steady power input with an average voltage value is provided to the device. Average voltage value is the result of the percentage of the “on time” [2].

The benefit of PWM is that power loss is very less. Compared to an analog potentiometer to limit the power output by choking the electrical Pathway, thereby resulting in power loss as heat, PWM actually turns off the power output rather than limiting it. When the signal is high it is said to be “on time”. To describe the amount of “on time”

the concept of duty cycle is used. Duty cycle is measured in percentage [3].

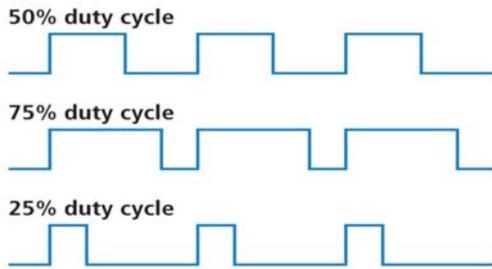


Figure 1. Duty cycle of PWM signal.

III. SOFTWARE

CVAVR is a C compiler program developed by Pavel Haiduc. It has made c programming more easy for all user. CVAVR is a part of Atmel Studio Microcontroller. The main advantage of using CVAVR over other compilers is that it stores the data in a flash memory rather than storing in the ram of the computer which makes the program faster than other compilers. The AVR C compilers supports most of the data type such as bit, bool, char, int, short, long and float. It also has interrupts for quick debugging and building. The compiler optimises the loops for stable processing and also eliminates the redundant sub expression of the program [4].

Proteus is a VSM and circuit simulation application. The software has microprocessor models to co-simulation of the whole microcontroller based design with this we can check the working of the embedded system designed by interaction between software running on a microcontroller. Software can stimulate the input/output, interrupts, timers, UART, and any other peripheral present on supported processor.

Proteus ISIS allows the user to generate real circuit board and this helps in checking the working of the design which will be working in the PCB with ease.

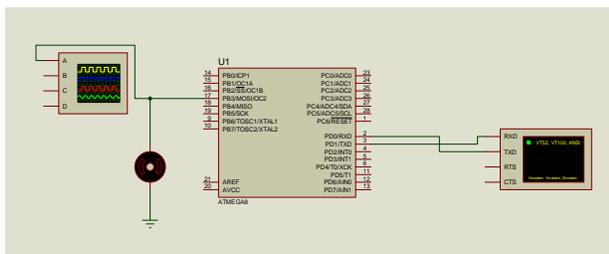


Figure 2. Simulation view of the proposed system.

The software uses the hex file generated by the CVAVR to code the chip selected in it. This software allows us to change the frequency of the chip for testing [5].

IV. WORKING

As the circuit is energised, user can open the android application in his device and as the value will be entered in terms of percentage of duty cycle on the app, this data is sent to the microcontroller as a command. The microcontroller receives the data using UART communication protocol. The data is then converted into the required value to change the speed from the percentage using the equation created and if the data received is correct then received data is then further processed using the program encoded in the microcontroller.

If the data is incorrect then the user gets a message to re-enter the data as received data was incorrect. After the data is verified by the program the duty cycle is generated accordingly by using microcontroller internal PWM generating circuitry. Output to the motor is controlled is by giving steady power input with an average voltage value to the device and speed is finally controlled.

With every command, user receives the information about current duty cycle on the android app screen of the device and option will be provided to further change the duty cycle to vary the speed of the motor. This process is a continuous process which keeps on going till the circuit is energized a shown in figure 3.

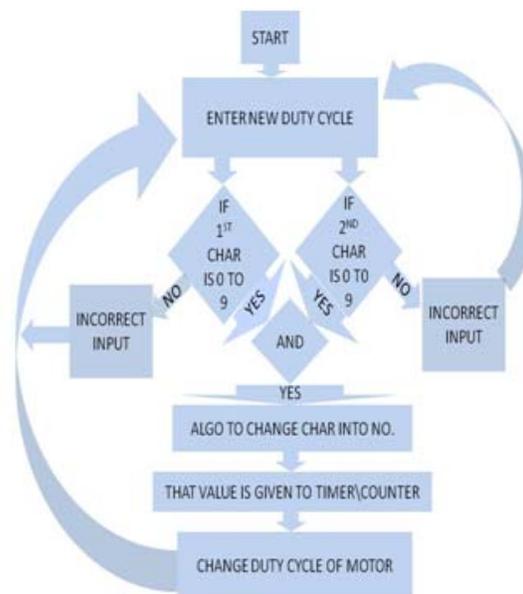


Figure 3. Flowchart of working.

V. CONCLUSION

The proposed system can be used to change the speed of the dc motor wirelessly. The accuracy of the system is very much because of digital control of the system. PWM controlling of the motor speed reduces heat losses in the system. The proposed system can save money as well as time because it can be controlled by using any smart phone or Bluetooth based device and introduced handshaking makes the system more user friendly. Proposed system has lots of future possibilities as it will modernize the way of working in industries.

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