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SOFT SPEED CONTROL OF BLDC MOTOR BY USING GESTURES

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ABSTRACT: This project demonstrate system for controlling the speed by PWM of a DC motor. Power semiconductor technologies have radically transformed drive control in recent years, particularly in control using thyristors, IGBTs, power MOSFETs, and other devices.The project is made up of an 89c52 microcontroller, a motor , a heat sensor, a comparator, a keypad, LCD display, and a rotation feedback sensor . The software is written in microcontroller and takes the user's input data before rotating the motor with a 50 percent duty cycle pulse. The motor rotates at X RPM, which may be monitored with the help of a feedback sensor and a microcontroller. If the speed exceeds the limit,

Keywords: IGBTs, MCS 51 series 89c52 microcontroller , and 16X2 dot matrix LCD display are some of the terms used in this paper.

I. INTRODUCTION

In today's industry, there is an increasing need for process automation in all areas. Automation improves quality, increases production and reduces costs. A frequency converter that can control the speed of an AC / DC motor is an essential control element in an automated system. Depending on the application, some of them are fixed speed drives and some of them are variable speed drives. Variable speed drives had various limitations until decades ago. For example, the introduction of a multi-functional microcontroller on the same silicon wafer has completely changed the scene. Today, variable speed drive systems are not only small, but also very efficient and highly reliable, meeting all the stringent requirements of today's diverse industries. Direct currents (DC) motors have been used in variable speed drives . The characteristics of dc motors provide high starting torques which is required for drives. Control over a speed range, both below and above the rated speed can be very easily achieved. The methods of speed control are simpler and less expensive than those of alternating current motors. There are different techniques available for the speed control of DC motors. Although phase control methods are widely used, they have certain limitations. Primarily, the power lines generate harmonics, and there is also p.f if operating at low speeds. In the proposed project, a circuit for a 5 hp direct current motor is designed and developed using pulse width modulation (PWM). Pulse width modulation can be achieved in a variety of ways. In this project, PWM is generated using a microcontroller. Feedback from the motor is needed to improve speed control. Feedback can be provided using either a tachogenerator or an optical encoder. Alternatively, the counter electromotive force itself can be used. In this project, feedback was implemented using the electromotive force of the armature as a feedback signal. The proposed project is a real-time work project, which can be done even more improvised using other safety features such as field current, air gap flux, armature current.

II. RELATEDWORKS

When people speak, they gesture. Gestures are a fundamental component of language, providing meaningful and unique information to the spoken message and reflecting the speaker's underlying knowledge and experience. The theoretical perspective of language and gestures suggests that they share a common conceptual origin and have a tightly integrated relationship in which time, meaning, and function intersect to enrich the context of communication. To do.

• The Gesture and Gesture Sketch Model (de Ruiter, 2000) is an extension of Rebelt's classic model of language generation in that language and gestures are integrated but described as a separate system. It is different from McNeil's growth point theory. The sketch model proposes that gestures and languages are parallel but follow different production routes, each of which stems from a shared communication intent. Conceptors include both size, speed, and PREVERBAL messages for speech and space-spatial sketches of the ideas of ideas. Therefore, the language and gesture are planned together before language creation. Next, these conceptualizations are diverging one of two routes. A voice filter or gesture planner develops an engine program for each language and a gesture to cause open movement. This model can affect both language and gesture production failures, but faults can have different impact on speech and gestures. Modality can compensate for others. This is important as it suggests that the gesture is stored and thus maintain its communication function and cognitive function in the presence of voice or language disorder. This model has recently been revised and has a modified redundant sketch model with modified assumptions, which is mainly symbolic gesture , which is the content and redundancy of the language (DE RUITER, 2017, DE BIER et al. , 2019).

• Interface Model (Kita and özyilrek, 2003) is also an extension of LevelT Voice Production Model (1989), but in addition to communication intention and PrechLin Plan creation, we recommend that you choose a formula modality. Language and gestures are then generated from two separate systems. Action generator is a system that formulates system and statements of bi-directionally communicated systems between spatial and electrical image action schemes and conceptualization. Thus,
is organized and filled for speech production as well as spatial and motor characteristics of the reference. In addition, conceptualization hypotheses gestures (Kita et al., 2017) suggest that it is a base of an action scheme outside of a statement for speaking. Therefore, self-oriented functions for talking and thinking. • Previous research is mainly characterized by PWA gesture production to check if language defects have been extended to the same interruption of manual modalities (see Rose 2006 for historical testing). These studies confirmed that PwA made gestures (eg, Herrmann et al., 1988; McNeill, 1992; Goodwin, 2000). However, their gestures look different from the gestures of individuals who have no brain damage. People with aphrodisiac have a lower rate of gestures per minute than healthy controls (Cicone et al., 1979; McNeill, 1992), but probably because they have fewer words per minute, gestures per word. The rates are higher (Feyereisen, 1983; Carlomagno et al Cristilli, 2006; Sekine et al., 2013; de Beer et al., 2019) and more diverse gesture types than healthy participants (Sekine and Rose, 2013). .. Gesture generation also seems to depend on the type of aphrodisiac and the level of fluency. Cicone et al. (1979) Gesture shapes match verbal output, less fluent aphasia people produce less clear and informative gestures, and fluent aphasia people often produce vague gestures. discovered. In contrast, other studies have found that people with fluent aphasia make gestures more often than people with fluent aphasia (Kong et al., 2017). In storytelling tasks, those who were not fluent in Broca's area produced almost twice as many

gestures per 100 words as those who were fluent in Wernicke's aphasia, and the types of gestures were different. People with Broca's aphasia were more likely to produce meaningful gestures, such as symbolic gestures, and people with Wernicke's aphasia were more likely to produce beats and figurative or abstract gestures (Sekine et). al., 2013). However, while people with Broca's aphasia appear to generate more symbolic gestures per word, people with Wernicke's aphasia produce more symbolic gestures per unit time (Carlomagno and Cristilli, 2006). Importantly, brain lesions that cause aphasia often cause contralateral hemiplegia or limb apraxia, which limits limb use and can therefore affect gestures (Rose for efficacy review). , 2006). However, in a study comparing people with aphasia with or without hemiplegia, the number of gestures produced per word (Kong et al., 2015) or the intelligibility of the gestures produced (Hogrefe et al., 2012). , 2016) There is no difference.

III. METHODOLOGY

DC motors are generally much more adaptable speed drives than AC motors connected to a constant speed rotating magnetic field. In fact, one of the main reasons for the strong competitiveness of DC motors in modern industrial drives is the wide range of specifications we are familiar with.

N = K (/ ϕ)

= K (VIa Ra / ϕ) where V = supply voltage (volt) Ia = armature current (ampere)

Ra = Armature resistance Φ = Magnetic flux per pole (Weber)

This equation gives two valid methods of velocity change, namely.

a) The change in field excitation when this causes the magnetic flux Φ per pole is known as field control.

b) Fluctuation of terminal voltage (V). This method is known as anchor control.

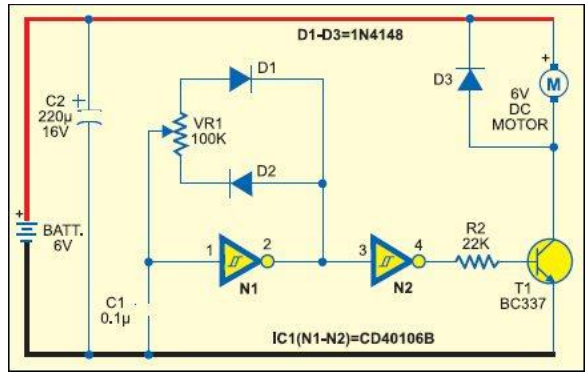

Fig. 1: DC Motor speed control by PWM

PWM TECHNIQUE:

Pulse Width Modulation (PWM) or duty cycle variation techniques are commonly used in direct current motor speed control. Duty cycle is defined as the percentage of digital "high" to digital "low" and digital "high" pulse widths during the PWM period.

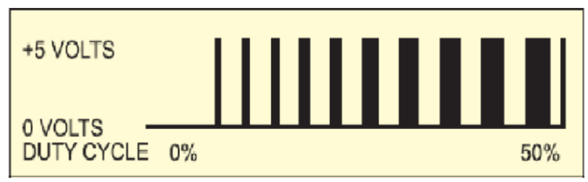

Fig. 2: 5V Pulses With 0% Through 50% Duty Cycle

The voltage reading for a 0% duty cycle is zero. At a 25% duty cycle, the average value is 1.25V (25% of 5V). At 50% duty cycle the average is 2.5V, at 75% duty cycle the average voltage is 3.75V and so on. The maximum duty cycle can be 100%, which corresponds to the DC waveform. Therefore, by changing the pulse width, the average voltage of the DC motor, that is, its speed, can be changed. The average voltage can be calculated from the following formula.

ý = D Ymax + (1 d) ymin

, usually equal to zero, so average voltage:

= d. Ymax

is, for example, a simple velocity regulator circuit for mini DC motors in tape. Area and toy.

a) Create a PWM with a frequency of 1 kHz and 50% work cycle and write a mount program for viewing signals with an oscilloscope. B) Connect the signal to the motor driver. The main reason for using pulse

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width modulation in DC engine control is to avoid excessive heat dissipation in a linear power amplifier. Heat dissipation problems often lead to large heatsinks and, in some cases, forced cooling. PWM amplifiers have much higher power conversion efficiency, which greatly reduces this problem

. In addition, the PWM driver input signal can be obtained directly from any digital system without the need for a D / A converter. The PWM output stage has its drawbacks. The signal of interest is converted to the duration (or duty cycle) of the pulse, not the voltage amplitude. This is clearly not a linear operation. However, with some assumptions that are usually valid for motor control, PWM can be approximated as linear (that is, pure gain). The linear model of a PWM amplifier is based on the average voltage equal to the integral of the voltage waveform. therefore

VS * ton = Veq * T

Where

VS = supply voltage (+12 volts) Ton = pulse duration

Veq = average or equivalent voltage seen from the motor T = switching period (1 / f)

The recommended switching frequency is 300 Hz. The

switching frequency (1 / T) is determined by the characteristics of the motor and drive. The

control variable is the duty cycle, which is Ton / T. The duty cycle must be recalculated at

every sampling time. Therefore, the voltage perceived by the motor is Veq, which is equal to the duty cycle multiplied by the supply voltage.

Principle

Pulse width modulation control is turned on / off very quickly to switch power supplied to the motor. DC voltage is converted to a bound square wave signal between complete- (approximately 12V) and zero, and a series of power "kicks" is given to the engine. Pulse width modulation technology (PWM) is a technique for speed control that can overcome the problem of poor motor start power. PWM for engine speed control works very similar. Instead of providing a voltage that changes to a motor, it is supplied with a fixed voltage value (eg, 12 V), which is immediately

. Then remove the voltage and the motor "inertia". This voltage ON / OFF cycle can be controlled by continuing this voltage ON / OFF cycle in a variety of work cycles. In any case, the signal has a maximum value of 12V and 0V and the minimum voltage. • In the waveform, the signal is the ratio of 1: 1 marking room. • In the waveform, the signal has a ratio of 3: 1 marking room, which means that the output is 75% to 12V. This obviously extends the motor at 3/4 of maximum velocity, as it provides an average output voltage of 9 V. • In the waveform, the signal has a ratio of 1: 3 marking chamber, where it is an output signal of 12V for 25%. The average output voltage of this signal is only 3 V, and the motor extends at 1/4 of the maximum speed.

The use of pulse width modulation for controlling small motors has the advantage that the loss of power of switching transistors is small because the transistor is completely "on" or completely "off". As a result, the switching transistor has lower power consumption, which gives a linear control type and provides better speed stability. Also, since the amplitude of the motor voltage remains constant, the engine is always full strength. As a result, the motor can rotate much slower without stalling. So how can you generate a pulse width modulated signal to control the motor? It is simple and uses the Astable555 oscillator circuit as shown below.

IV. BLOCK DIAGRAM

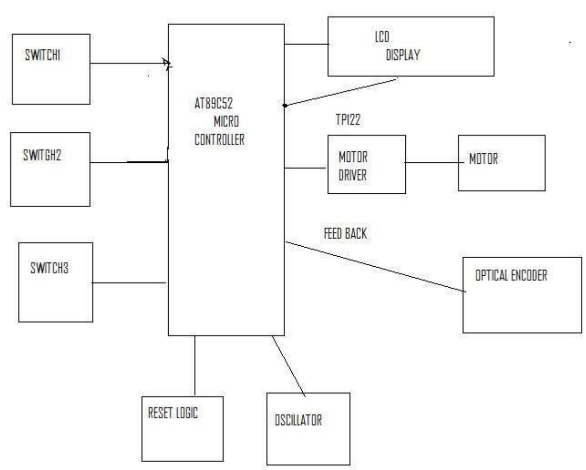

Fig 3: Block Diagram

A. SWITCHES

“The three switches are connected to p1.1,p1.2,p1.3, of micro controller when switch is open the port maintains logic high When the switch is depressed maintains high the logic 0.these 3 switches are pulled to Vcc via 10k resistor the type of switch press to on . In electronics, a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from oneconductor to another. The most familiar form of switch is a manually operated electro mechanical device with one or more sets of electrical contacts. Each set of contacts can be in one of two states: either 'closed' meaning the contacts are touching and electricity can flow between them, or 'open', meaning the contacts are separated and no conducting.”

B. PWM GENERATOR CHIPS

“There are a few Ic‟s accessible which changes over a DC leveldesigned for use in switch mo power supplies .tragically, the gadgets intended for switch mode power supplies not to permit the imprint space proportion to modify over the whole 0 - 100 percent range. many cutoff the greatest to 90% which is actually restricting the power you can ship off the engines. gadgets planned as heartbeat generators ought to permit the entire reach to be utilized.”

C. LCD

“LCD (Liquid Crystal Display) screens are electronic display modules that may be used in a variety of applications. A 16x2 LCD display is a common component in many devices and circuits. Seven-segment and other multi-segment LEDs are preferable to these modules. This is because of the following reasons: LCDs are inexpensive, simple to programmed, and allow for the display of distinctive and even original characters (as opposed to seven segments), animations, and other effects. A 16x2 LCD may have 16 characters per line on each of its two lines. A 5x7 pixel matrix is used to represent each character on this LCD. Command and Data are the only two registers on this LCD. A file is preserved for the LCD command instructions. LCD screens (Liquid Crystal Display) are electrical display modules that may be found in the command register. A command tells the LCD to perform a certain task, such as initialising it, cleaning its screen, setting the cursor location, managing the display, and so on. The information that will be shown on the LCD is stored in the data register. The ASCII value of the character to be shown on the LCD is the data.”

D. MPU 6050

“The MPU6050 ™ part is the world's first motion tracking device designed to meet the low power, cost, and high performance requirements of smartphones, tablets, and wearable sensors.

The MPU6050 includes InvenSense's MotionFusion ™ and runtime calibration firmware, eliminating the need for manufacturers to integrate discrete devices into costly and complex system-level selection, certification, and motion-enabled products, and sensors. Fusion algorithms and calibration procedures ensure optimal performance for consumers.”

E. 89C52 MICROCONTROLLER:

“The microcontroller is the actual computer on the chip. Microprocessors are intended as general purpose digital computers, and microcontrollers are intended as special purpose digital controllers. In general, a microprocessor contains a CPU, a memory addressing unit, and an interrupt handler circuit. The microcontroller has these features in addition to timers, parallel and serial I / O, internal RAM and ROM. Like microprocessors, microcontrollers are general-purpose devices, but they are designed to read data and control the environment based on their calculations. The difference between a microcontroller and a microprocessor is best illustrated by the fact that the microprocessor has a lot of working code to move data from external memory to the CPU. You can have one or two microcontrollers. The microprocessor can contain one or two types of bit processing instructions. There are many microcontrollers. The microprocessor handles the high-speed transfer of code and data from an external address to the chip. The microcontroller handles the fast movement of bits in the chip. The microcontroller can function as a computer without the need for additional external digital components. Many additional parts are required for the microprocessor to function. In general, 4-bit microcontrollers are widely used as real one-chip computers.”

F. Atmega328

"The Arduino UNO is an open-source microcontroller board manufactured by Arduino and based on the Microchip ATmega328P microprocessor. The board has a number of advanced and simple data/yield (I/O) sticks that may be attached to various development sheets (shields) and circuits. The board includes 14 digital connections and 6 analogue pins, and it can be programmed with the Arduino IDE using a USB type B connection (Integrated Development Environment). It can be powered by USB or an external 9-volt battery, although it can only detect voltages between 7 to 20 volts, which is similar to the Arduino Nano and Leonardo. The system reference configuration is available on the Arduino website under a Creative Commons Attribution-Share Alike 2.5 license..There is also design and introduction information for suitable duplicates of the equipment. The name "Uno" was selected to mark the introduction of Arduino Programming (IDE) 1.0. It means "one" in Italian. The Uno board and Arduino Software (IDE) version 1.0 were the reference versions of Arduino, and are now superior to newer releases. The Uno board, as well as the Arduino stage's reference version, are essential in the production of USB Arduino sheets. The Arduino Uno's ATmega328 chip has a boot loader that allows you to upload new code without a software developer. It delivers its message during the main STK500 conference. The Uno also differs from previous boards in that it does not have the FTDI USB-to-sequential driving force chip. Rather, it uses an Atmega16U2 (or an Atmega8U2 in the case of version R2) as a USB-to-sequential converter."

G. EXTERNAL RAM

"This RAM memory is off-chip. It often takes the form of standard static RAM or flash RAM. As an obvious part of the internal RAM, the 8051 also supports what is known as the external RAM. As the name implies, external RAM is off-chip random access memory. Since memory is off-chip, access is less flexible and slower. For example, to increment the internal RAM location by one requires only one instruction and one instruction cycle. It takes 4 and 7 instruction cycles to increment the 1-byte value stored in the external RAM. In this case, the external memory will be 7 times slower. As the speed and flexibility of the external RAM slows down, the amount increases. The internal RAM is limited to 128 bytes (256 bytes on the 8052), but the 8051 supports up to 64KB of external RAM."

H. MOTOR AND MOTOR DRIVER:

"The purpose of the engine speed governor is to receive a signal representing the requested speed and drive the motor at that speed. The controller may or may not actually measure the speed of the motor. In this case, it is called the closed-loop speed controller or closed-loop speed controller, otherwise it is called the open-loop speed controller. Feedback speed control is good, but it is more complex and may not be necessary for simple robot designs. There are various types of motors, and the motor drive performance of the speed controller depends on these types. The speed controllers presented here are designed to drive simple and inexpensive starter motors from cars that can be purchased at any junkyard. These motors are usually wound in series. In other words, it's the other way around. They need to be changed slightly (see engine section). Below is a simple block diagram of the speed controller. Let's take a closer look at the important parts block by block."

V. CIRCUIT OPERATIONS

Pulse Width Modulation (PWM) or duty cycle variation techniques are commonly used in direct current motor speed control. Duty cycle is defined as the percentage of digital high pulse width in addition to digital high to digital low during the PWM period. Figure 1 shows a 5V pulse with a duty cycle of 0% to 50%. The average DC value for a 0% duty cycle is zero. At a 25% duty cycle, the average value is 1.25V (25% of 5V). At 50% duty cycle the average is 2.5V, at 75% duty cycle the average voltage is 3.75V and so on. The maximum duty cycle can be 100%, which corresponds to the DC waveform.

Therefore, by changing the pulse width, the average voltage of the DC motor can be changed, and therefore its speed. Figure 2 shows the circuit of a simple speed controller for a mini DC motor used in tape recorders and toys. Here, the inverted Schmitt trigger N1 is configured as a stable but variable duty cycle. The total in-circuit resistance of VR1 is 100K ohms in a full cycle, but the part used during the positive and negative periods of each cycle can be changed by changing the position of the wiper contacts to get the variable pulse width. .. The Schmidt Gate N2 acts as a buffer / driver to drive the transistor T1 and sits recursively positively on its base.

Therefore, the average amplitude of the DC drive pulse or the speed of the motor M is proportional to the setting of the wiper position of the VR1 port meter. Capacitor C2 acts as a storage capacitor to provide a stable voltage to the circuit.

Therefore, by changing VR1, the duty cycle can be changed smoothly and continuously from 0% to 100% and the motor speed can be changed from stop to full speed. The diode effectively provides different timing resistance values during charging and discharging of the timing capacitor C1. The pulse or pause time is roughly given by: Pulse or pause time ≈ 0.4 x C1 (farad) x VR1 (ohm) seconds.

Here we use the in-circuit values of VR1 during the pulse or pause period, as appropriate. The frequency remains constant and is given by: Frequency ≈ 2.466 / (VR1.C1) ≈ 250Hz (for VR1 = 100 ohms and C1 = 0.1μF) Recommended value for in-circuit resistance should exceed 50 kilos Capacitor value should exceed 100 pf, Ohms are less than 2 mega ohms.

VI. RESULTS:

The speed of the brushless DC motor is controlled by the PWM system. The operating time controls the output of the motor. You can identify the appropriate tempo by changing the duty cycle. Modulation of the duty cycle of the DC motor is used to manage the pulse width. Average Voltage = D * Vin The average voltage achieved in some duty cycles is given when the voltage supply decreases with the percentage of duty cycles that decrease the average voltage. Duty cycle = 100% x pulse width / cycle where duty cycle (%) pulse width = time (seconds) cycle when the signal is on or high = cycle time (seconds). The duty cycle controls the speed of the brushless DC motor. You can recognize the required speed in different duty cycles. You can use Arduino uno pulse width modulation to monitor the operating period of the brushless DC motor and effectively adjust the speed of the brushless DC motor. The frequency and voltage can be displayed on the LCD16x2 panel. You can use IOT technology on your installed computer to track the same parameters from a distance. Various voltage and current velocities, as shown in the table below

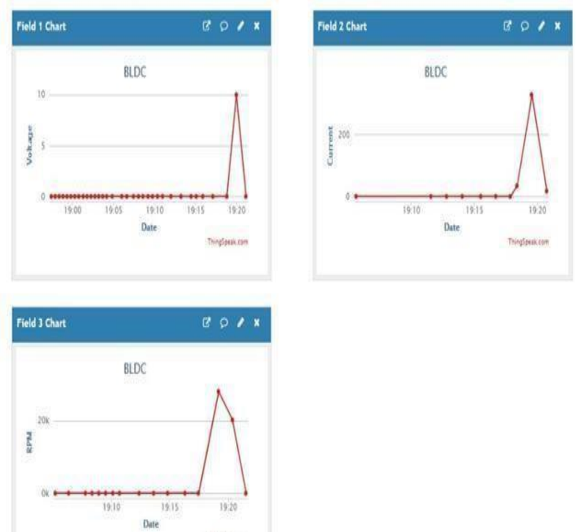

Fig 4: Current, voltage and speed displayed on IOT application

Fig 5 : Current , Voltage and Speed displayed LCD

VII. CONCLUSION:

With the help of this method, we can control the speed of the DC motor with just the movement of the hand, without a switch. This method can also be used for higher rated DC motors. The PWM technology used here helps to change the supply voltage of the motor. Because the microcontroller operates at high frequencies, the motor responds to the average of the pulses rather than the individual pulses. The main advantage of PWM is that the switching device consumes very little power. If the switch is turned off, if there is little power, if the power is turned on, there is almost no voltage drop across the switch. Performance losses, voltage and electrical product are both close to zero in both cases. This method is more preferably due to its low cost. The microcontroller also requires a simple command to change the duty cycle and frequency of the PWM control signal, and also finally to catch the gesture of our hand

, and they control them in PWM In the case, it may operate at a lower speed. Using analog current to control the motor, low speed and large torque does not occur. The magnetic field generated by the low current is too weak to rotate the rotor. On the other hand, the full intensity PWM current can generate a short pulse of the magnetic flux, whereby the rotor can be rotated at extremely low speed.

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