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Comparison and Analysis of Speed of a Motor Using PWM Technique

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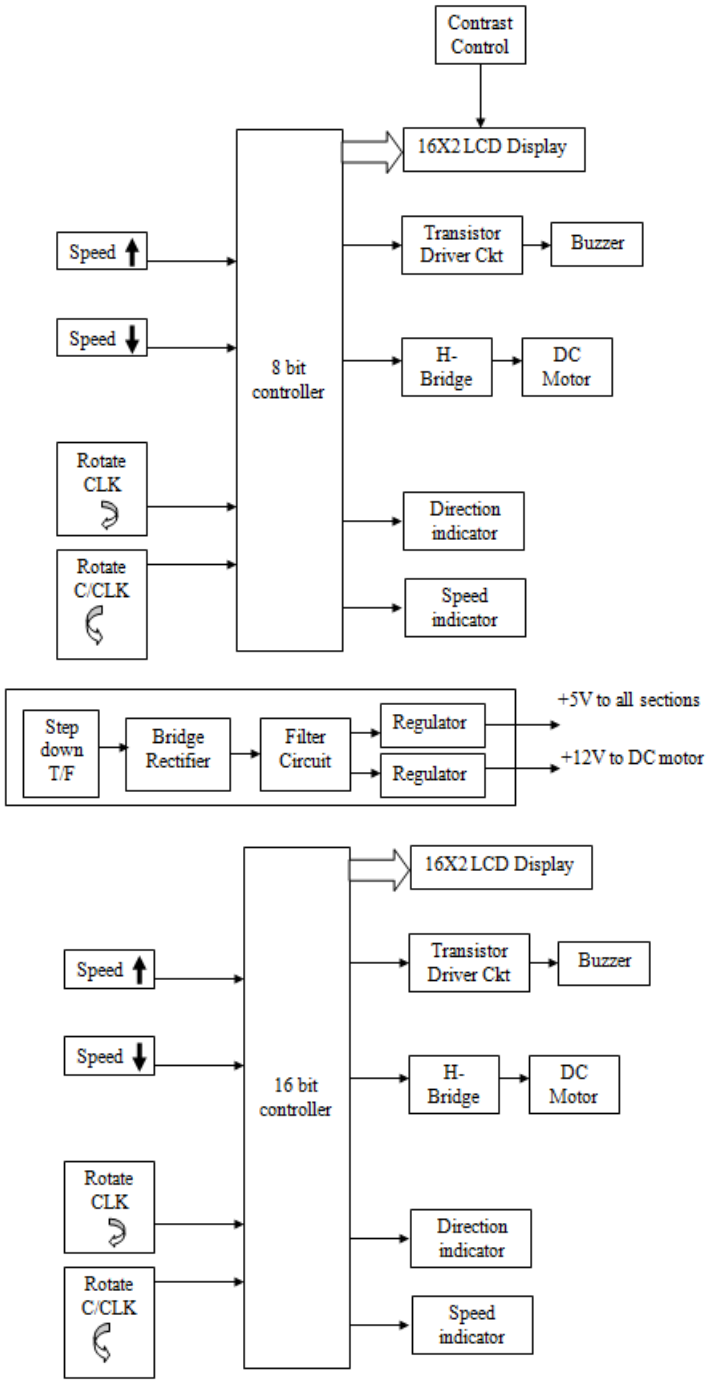
ABSTRACT;

This contribution describes three procedures and the related software operations which are used to obtain the pulse-width modulation (PWM) signal for industrial use. The hardware platforms used to generate the signals are embedded systems, manufactured in recent years. Three types of microcontrollers based on their register architecture were used: 8-bit , 16-bit and 32-bit controllers. PWM is preferred way for control in modern semiconductor devices. The very short rising and falling time ensure the minimum of switching transition time respectively of the switching losses.

In this context, the paper will analyze comparatively a new structure, related on a classical reference structure, both the hardware and the software. At the end of the paper some conclusions might be drawn on the code length, system latency and the technicalOne additional advantage of pulse width modulation is that the pulses reach the full supply voltage and will produce more torque in a motor by being able to overcome the internal motor resistances more easily. Two push-to-on switches are provided for increasing / decreasing the speed of the motor. Two more push-to-on switches are provided to rotate the motor in Clock wise / Counter clock wise direction. 16X2 LCD is connected to display the speed level of the motor and the direction. LED indication is also provided for visual indication.

A buzzer is provided for audio indication of DC motor speed variation and change in direction. Whenever the speed is increased / decreased, the system acknowledges by a short beep. This buzzer is driven by transistor driver circuit.This project uses regulated 5V, 500mA & 12V, 500mA power supply. 7805 and 7812 three terminal voltage regulators are used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac out put of secondary of 230/12V step down transformer.

Block Diagram:



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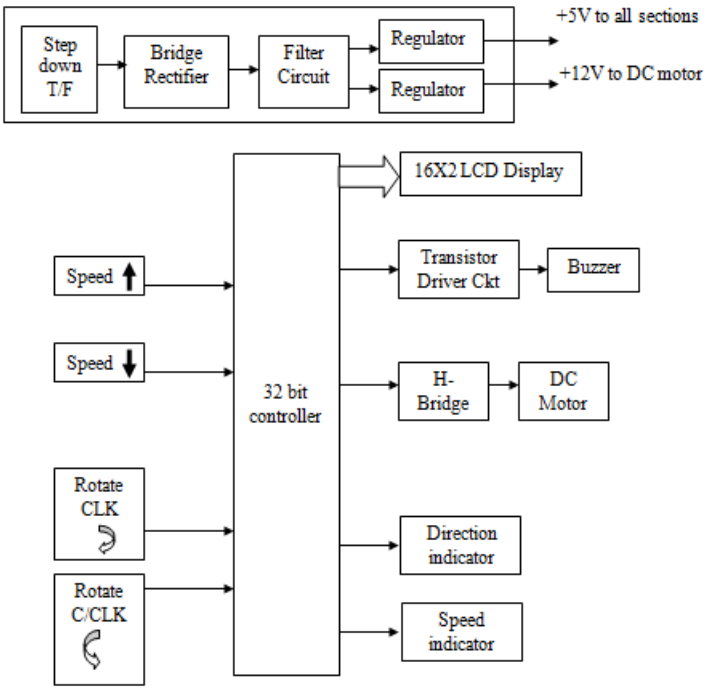
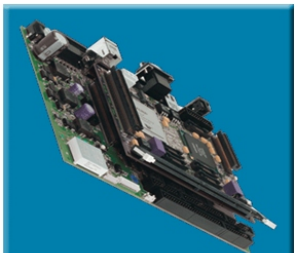


8 BIT MICRO CONTROLLER: 8052 MICROCONTROLLER MEMORY ORGANIZATION:

The microcontroller memory is divided into Program Memory and Data Memory. Program Memory (ROM) is used for permanent saving program being executed, while Data Memory (RAM) is used for temporarily storing and keeping intermediate results and variables. Depending on the model in use (still referring to the whole 8052 microcontroller family) at most a few Kb of ROM and 128 or 256 bytes of RAM can be used. However… All 8052 microcontrollers have 16-bit addressing bus and can address 64 kb memory. It is neither a mistake nor a big ambition of engineers who were working on basic core development. It is a matter of very clever memory organization which makes these controllers a real "programmers' tidbit".

32-Bit Controller ARM PROCESSOR



ARM7TDMI Processor Core

•Current low-end ARM core for applications like digital mobile phones
•TDMI
oT: Thumb, 16-bit compressed instruction set
oD: on-chip Debug support, enabling the processor to halt in response to a debug request
oM: enhanced Multiplier, yield a full 64-bit result, high performance
oI: Embedded ICE hardware
•Von Neumann architecture

16 BIT MICRO CONTROLLER MSP430 Family Mixed-Signal Microcontroller:

The MSP430 is a 16-bit microcontroller that has a number of special features not commonly available with other microcontrollers:

• Complete system on-a-chip — includes LCD control, ADC, I/O ports, ROM, RAM, basic timer, watchdog timer, UART, etc.
• Extremely low power consumption — only 4.2 nW per instruction, typical
• High speed — 300 ns per instruction @ 3.3 MHz clock, in register and register addressing mode
• RISC structure — 27 core instructions
• Orthogonal architecture (any instruction with any addressing mode)
• Seven addressing modes for the source operand
• Four addressing modes for the destination operand
• Constant generator for the most often used constants (–1, 0, 1, 2, 4, 8)
• Only one external crystal required — a frequency locked loop (FLL) oscillator derives all internal clocks
• Full real-time capability — stable, nominal system clock frequency is available after only six clocks when the MSP430 is restored from low-power mode (LPM) 3; — no waiting for the main crystal to begin oscillation and
•stabilize

DC MOTOR:

The speed of a DC motor is directly proportional to the supply voltage, so if we reduce the supply voltage from 12 Volts to 6 Volts, the motor will run at half the speed. How can this be achieved when the battery is fixed at 12 Volts?

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The speed controller works by varying the average voltage sent to the motor. It could do this by simply adjusting the voltage sent to the motor, but this is quite inefficient to do. A better way is to switch the motor's supply on and off very quickly

CONCLUSION:

The purpose of the this paper was to present three procedures and the related software operations which are used to obtain the pulse-width modulation (PWM) signal for industrial use by using three different microcontrollers. Each PWM generation procedure is simple and 100% safe, so the main goal of the paper was achieved. Depending on the industry process where the microcontrollers are used, each of the presented microcontroller architectures can be easily used.

For simple PWM control of some small-sized DC motors, the 8-bit microcontroller has the advantage of quickly programming and fast response. For some advanced PWM techniques and additional processing functions for a much more complex automation process control, the use of an 16-bit, or 32-bit microcontroller is a good choice. Depending on the industry process type, the presence of parasite signals (noise) could be a problem.

FUTURE SCOPE:

For future research, all three microcontrollers presented in this paper will be interfaced with a MOSFET driver and a thyristor bench test. This will lead to some experimental analysis of total harmonic distortion in the both control and the power signal with interpretation of practical results.