International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 4, Issue 4, April 2015

PWM Generation using N2HET and UART to control the wheel speed

Sudha.S[#1], Ragavi.R[*2]

[#1]*PG Scholar, Department of EEE, Kongu Engineering College, Perundurai, India*
[*2] *PG Scholar, Department of EEE, Kumaraguru College of Technology, Coimbatore, India*

Abstract: **ABS is the standard today in all cars. Wheel sensors are the most heavily stressed components of the brake control system. They prevent the wheels from spinning and ensure proper road holding. Processors monitor the actual speed of the wheel and adjust the power to the motor if required to maintain the correct speed. This paper explains the transmission of speed information to the control unit through UART and controlling the speed by generating the PWM signal using HET.**

***Keywords*— HET; UART; PWM Generation; wheel speed.**

I. INTRODUCTION

A. N2HET:

High-End Timer (N2HET) software controlled timer with a dedicated specialized timer micromachine and a set of 30 instructions. The N2HET micromachine is connected to a port of up to 32 input/output (I/O) pins. The timer module provides sophisticated timing functions for real-time applications such as engine management or motor control. The high resolution hardware channels allow greater accuracy for widely used timing functions such as period and pulse measurements, output compare, and PWMs. The N2HET module comprises four separate components: Host interface, N2HET RAM, Specialized timer micromachine, I/O control.

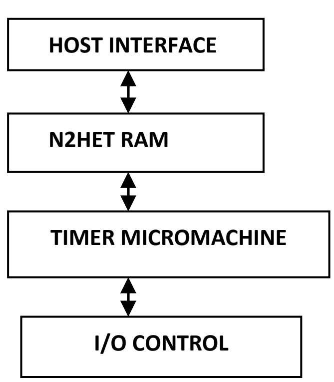

Fig.1 HET MODULE

Host interface is to interface with the peripheral bus (CPU). The host interface controls all communications between timer-RAM and masters accessing the N2HET RAM. The N2HET contains RAM into which N2HET code is loaded. The N2HET code is run by the specialized timer micromachine. The N2HET has its own instruction set. The timer micromachine reads each instruction from the N2HET RAM. The program and control fields contain the instructions for how the specialized timer micromachine executes the command. For most instructions, the data field stores the information that needs to be manipulated. The specialized timer micromachine executes the instructions stored in the N2HET RAM sequentially. The N2HET program execution is self-driven by external or internal events. This means that input edges or output compares may force the program to branch to special routines using a conditional address. I/O control provides an interface to external pins. The N2HET has up to 32 pins. All of the N2HET pins available are programmable as either inputs or outputs. In addition all 32 I/Os have a special HR structure based on the HR clock. This structure allows any N2HET instruction to use any of these I/Os with an accuracy of either loop resolution or high resolution accuracy.

B. UART:

A universal asynchronous receive/transmit (UART) is an integrated circuit which plays the most important role in serial communication. It handles the conversion between serial and parallel data. It contains a parallel-to serial converter for data transmitted from the computer and a serial to parallel converter for data coming in via the serial line. The UART also has a buffer for temporarily storing data from high speed transmissions. In addition to the basic job of converting data from parallel to serial for transmission and from serial to parallel on reception, a 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 serial communication module is divided into three sub-modules: the baud rate generator, receiver module and transmitter module. The baud rate generator is used to produce a local clock signal which is much higher than the baud rate to control the UART receive and transmit; The UART receiver module is used to receive the serial signals at RXD, and convert them into parallel data; The UART transmit module converts the bytes into serial bits according to the basic frame format and transmits those bits through TXD.

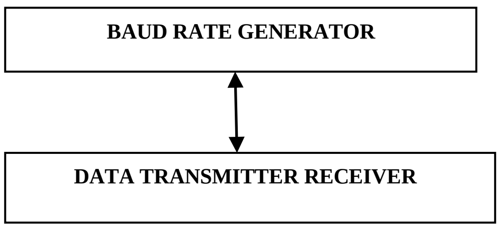

Fig. 2 UART MODULE

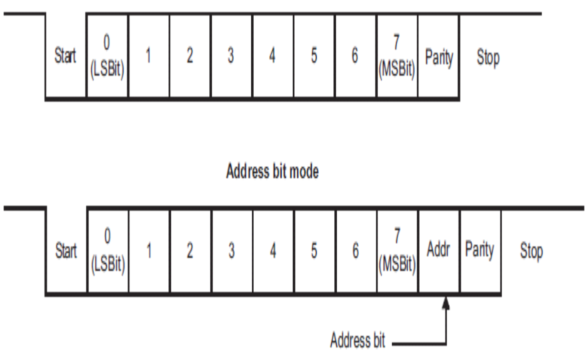

Fig.3 UART FRAME FORMAT

It usually includes start bit, data bit, parity bit, stop bit as shown in fig 3.When a word is given to the UART for Asynchronous transmissions, a bit called the "Start Bit" is added to the beginning of each word that is to be transmitted. The Start Bit is used to alert the receiver that a word of data is about to be sent, and to force the clock in the receiver After the Start Bit, the individual bits of the word of data are sent, with the Least Significant Bit (LSB) being sent first into synchronization with the clock in the transmitter. When the entire data word has been sent, the transmitter may add a Parity Bit that the transmitter generates. The Parity Bit may be used by the receiver to perform simple error checking. Then at least one Stop Bit is sent by the transmitter. If incorrectly formatted data is received, the UART may signal a framing error. If another byte is received before the previous one is read, the UART will signal an overrun error. Address bit is used in multi-processor communication.

II PWM GENERATION USING N2HET

All input captures, event counts, and output compares are executed once in each resolution loop. All 32 I/Os provide the HR structure based on the HR clock. HR clock is derived from system clock VCLK2. All pins have HR hardware so that these pins can be used as HR input captures (using the HR instructions PCNT or WCAP) or HR output compares (using the HR instructions ECMP, MCMP or PWCNT).

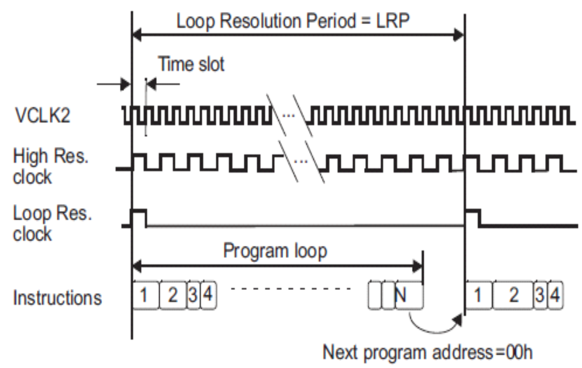

Fig.4 PROGRAM FLOW TIMINGS

AND / XOR-shared HR Structure (Output):

Usually the N2HET design allows only one HR structure to generate HR edges on a pin configured as output pin. XOR-shared HR Structure allows a logical XOR of the output signals of two consecutive HR structures N (even) and N+1 (odd).In this way, it is possible to generate pulses smaller than the loop resolution clock since both edges can be generated by two independent HR structures. This is especially required for symmetrical PWM. The hardware implementation would be based on Code Composer Studio. The proposed block diagram is shown below:

III. APPLICATION DESIGN

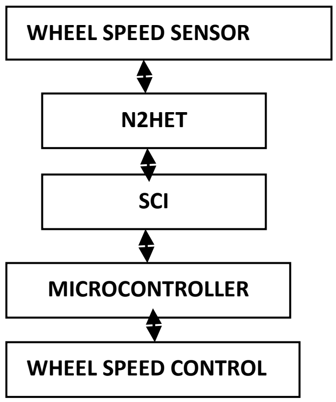

Fig.5 DESIGN FOR THE CONTROL OF WHEEL SPEED

The wheel speed sensor senses the speed of the vehicle wheel and sends the data to the controller. The microcontroller receives the data using serial communication interface. Based on the received data, time period and duty cycle is calculated and is periodically updated via SCI to HET. HET generates the PWM signal accordingly. For the newly updated duty cycle and period the action is taken on the next rising edge in order to avoid the missing pulse.

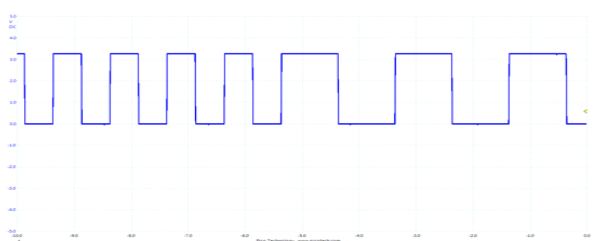

Fig.6 PWM OUTPUT

IV. CONCLUSION

From the reported work we are designing an application that explore usage of UART and N2HET for PWM generation to achieve benefits like great flexibility, low cost, high performance logic solutions and also meet communication demands quickly and efficiently in speed control applications.

REFERENCES

[1] Hercules Safety Microcontrollers – TEXAS INSTRUMENTS.

[2] Huimei Yuan, Junyou Yang,Peipei Pan," Optimized Design of UART IP Soft Core based on DMA Mode" 978-1-4244-5046-6/10/$26.00 c 2010 IEEE.

[3] Hazim Kamal Ansari, Asad Suhail Farooqi," Design Of High Speed Uart For Programming FPGA" International Journal Of Engineering And Computer Science Volume1 Issue 1 Oct 2012.

[4] Fei Wang (2002) "Sine-Triangle versus Space-Vector Modulation for Three-Level PWM Voltage-Source Inverters", *IEEE Transactions on Industry Applications*, Vol. 38, Nº 2, pp. 500-506.

[5] Khaleed E Addoweesh, et.al, " Induction Motor Speed Control Using a Microprocessor-Based PWM Inverter", IEEE transactions on Industrial Electronics, Vol 36, No 4, Nov 1989, pp 516-522.

[6] Prasad N Enjeti, et.al, "A new PWM Speed Control System for High Performance AC Motor Drives", IEEE Transactions on Industrial Electronics. Vol 37, No 2, April 1990, pp. 143-151.

S.Sudha received her Bachelor's degree Sri Krishna College of Engineering, Coimbatore, Tamilnadu, India in Electronics and Communication Engineering. Currently she is pursuing Master of Engineering (Applied Electronics) in Kumaraguru College of Technology, Coimbatore, India. Her area of interest is Embedded Systems. She has presented a paper in International conference

R.Ragavi received her Bachelor's degree Karpagam University, Coimbatore, Tamilnadu, India in Electronics and Communication Engineering. Currently she is pursuing Master of Engineering (Embedded Systems) in Kumaraguru College of Technology, Coimbatore, India. Her area of interest is Embedded Systems. She has presented a paper in National conference

