Design and Development of Texas Memory System 320F2810 on Embedded System Board

Vinay kumar T N

***Abstract*— In servo motor, servo refers to an error sensing feedback control which is used to correct the performance of a system. In motor control system we require the control circuit board and also the power electronic board which is used to generate the PWM signal. For implementing the control circuit, it is used for more than two applications. The board contains a configurable digital interface, which can be used to extend the functionality of the board by connecting analog and digital I/O peripherals. The control circuit system is designed and implemented with EAGLE software tool for PCB board design and texas instruments Code Composer Studio is a user-friendly, Windows-based debugger for developing and debugging software for the TMS320 processor.**

***Index Terms*— EAGLE software, Code composer studio, PCB board design, PWM signal, TMS320 processor.**

I. INTRODUCTION

Motors come in many different varieties for different applications. The term servo motor doesn't really apply to the motor itself, but rather the way in which the motor is used and controlled. In a position servo motor application, the idea is to hold the target load (generally attached to the motor shaft through a series of gears for speed and torque adjustment) in a given position. To accomplish a servo motor function, positioning information must be obtained from the output of the motor to provide feedback for the control system [1].

The servo motor is an error sensing control which is used to check and correct the system from any malfunctioning. The servo motor equipped with a servo mechanism for precise control of angular position. The RC servo motors usually have a rotation limit from 90° to 180°.but actually the Servos are used for precision positioning. They are used in robotic arms and legs, sensor scanners and in RC toys like RC helicopter, airplanes and cars [2].

In the servo motor there is few applications where we use the control circuit are brushless DC motors or BLDC motors. Brushless DC motors also known as electronically commutated motors (ECMs, EC motors) which are powered by a DC electric source via an integrated inverter, which produces an AC electric signal to drive the motor; additional sensors and electronics control the inverter output [3].

***Manuscript received June, 2015*.**
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BLDC motors may be described as stepper motors, however, the term stepper motor tends to be used for motors that are designed specifically to be operated in a mode where they are frequently stopped with the rotor in a defined angular position; this page describes more general BLDC motor principles, though there is overlap. Pulse width modulation is a powerful technique for controlling analog circuits with a processor's digital outputs [1].

II. PROBLEM STATEMENT

Digital motor control has been a challenging subject since the beginning of early implementations. Although digital control techniques and the availability of high-speed microcontrollers made life significantly easier for engineers, highly non-linear motor models, designing and tuning multiple control loops [4].

Texas Instruments understands the challenges facing motor control developers, and provides materials and tools that significantly accelerate development and troubleshooting of motor-control systems [5].

With C2000 Controllers, developers can now capitalize on the latest advancements in motor designs and control techniques. The C2000 controller platform also features flexible control capabilities. With the help of the TMS320F2810 controller we can able to design and develop the control circuit board to check the motor control by taking the feedback value of the current position by generating the PWM signals[3].

III. MOTIVATION

Aim in designing this project is to create a control circuit board for the motor control application using digital signal controller for the industrial application which has the capability to handle all the industrial process and effectively handle and process the related data. Embedded controller board is basically designed for the industrial application which can be used as a main controller.

IV. OVERVIEW OF PROJECT

Project work is to develop a digital signal processor (DSP) based controller circuit board using the Texas Instruments TMS320F2810 DSP processor. The board contains a configurable digital interface, which can be used to extend the functionality of the board by connecting analog and digital I/O peripherals.

ISSN: 2278 – 7798

The study aimed at meeting the following objectives:

- The main objective of my project is to develop a new control circuit board which can generate the pulse width modulation signals. The C2000 digital signal controllers Experimenter's Kit is a quick, easy, low cost way to evaluate the TMS320F28x family of devices. It gives the user access to all the F28x device's GPIO and ADC signals. Some of the key applications are 3-phase motor control, advanced sensing and power line modems.
- Motor control: C2000 controllers reduce the overall cost of motor-control systems by providing the integration and performance necessary to implement advanced control techniques.

V. MATERIALS AND METHODS

In motor control system like servo motors the current position is checked by taking feedback signal through PWM signal. To generate PWM we require a control circuit board. To design a control circuit board requires a EAGLE tool which is used to design and develop the printed circuit board[6].

A. Introduction to Eagle Software

The Eagle PCB layout software enables you to produce a schematic, turn this schematic into a PCB board, and, optionally, have an auto router layout the signal traces on the PCB for us. It has wide applications in the field of industries, education, and research.

Highlight a section that you want to designate with a certain style, and then select the appropriate name on the style menu. The style will adjust your fonts and line spacing. **Do not change the font sizes or line spacing to squeeze more text into a limited number of pages.** Use italics for emphasis; do not underline.

B. TMS320F2810 controller

The controller which is used in the design of the embedded control system is shown below.

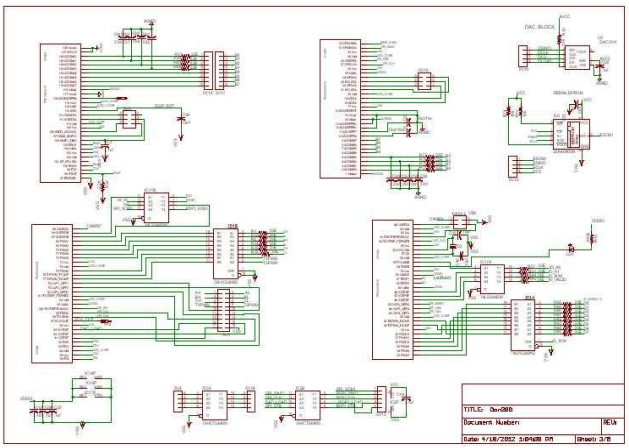

Fig. 1: Connections to TMS controller.

TMS320F2810 are device members of TMS320C28x™ DSP generation, are highly integrated, high-performance solutions for demanding control applications in Industrial environment. It consists of total of 128 pin PBK low profile quad flat pack (LQFP).

The board has been designed to meet different user interface requirements while providing a 4 layer DSP core with basic on-board functionality. The board is based around a Texas Instruments TMS320F2810PBK DSP, which has been specifically developed for use in digital motor/motion control applications. All digital I/O pins on the TMS320F2810 chip have the capability to operate in either “Digital I/O or “Peripheral I/O” mode. The TMS320F2810 DSP has 16 off ADC inputs that accept voltages in the range of 0-3V. The TMS320F2810 DSP supports 16 PWM channel outputs, made up of 6 complementary pairs (12 outputs), The DSP chip has two independent event manager modules and the PWM channels are evenly split between them.

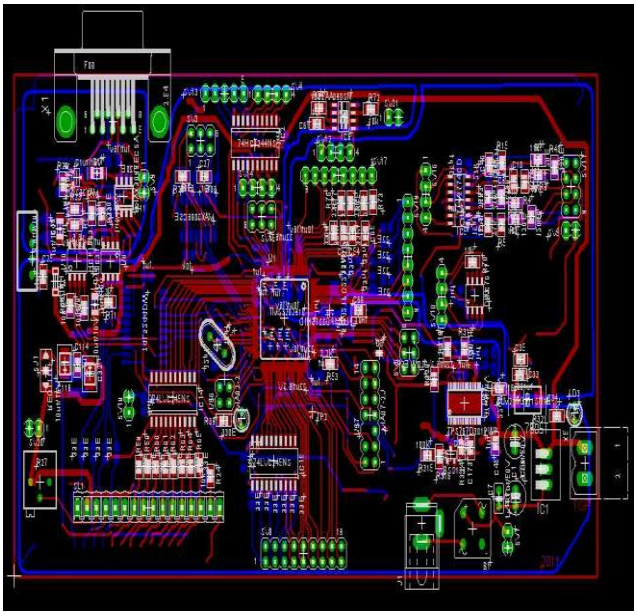

Fig. 2: Design of Project Board.

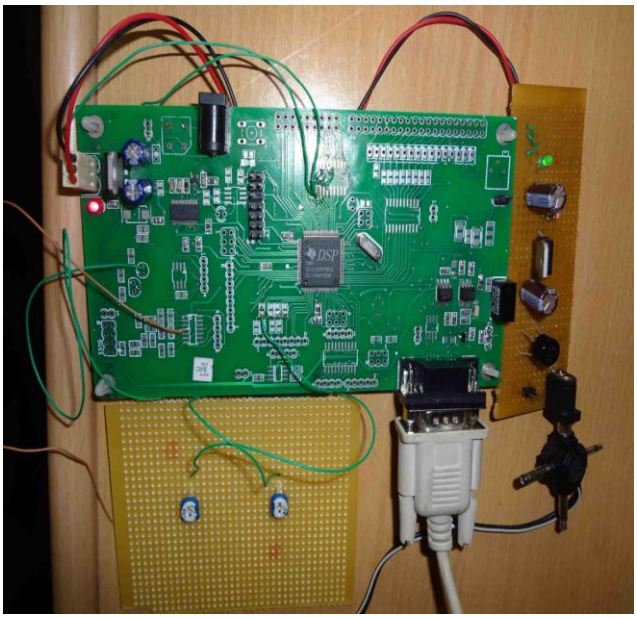

Fig. 3: Hardware connections for TMS320F2810 on embedded board.

ISSN: 2278 – 7798

A. Hardware Description

The digital signal processors are high performance microprocessor and have significant advantage among the normal general purpose microprocessors: they execute all their instructions at single clock, they have ample resources to do math jobs including hardware multipliers, instructions for working with tables etc. So do not wonder that fast fourier transformation or Filter design made in assembler for DSP takes few lines of code and executes hundreds of times faster than on normal general purpose processors.

VI. RESULT AND DISCUSSION

HyperTerminal is a program that we can use to connect to other computers, Telnet sites, and bulletin board systems (BBSs), online services, and host computers, using either our modem or a null modem cable.

A. Snap shot of the output

The snap shot which displays the Hyper terminal window. Hyper terminal is a program that you can use to connect to other computers. Hyper terminal records the messages passed to and from the computer or service on the other end of our connection is shown in figure.

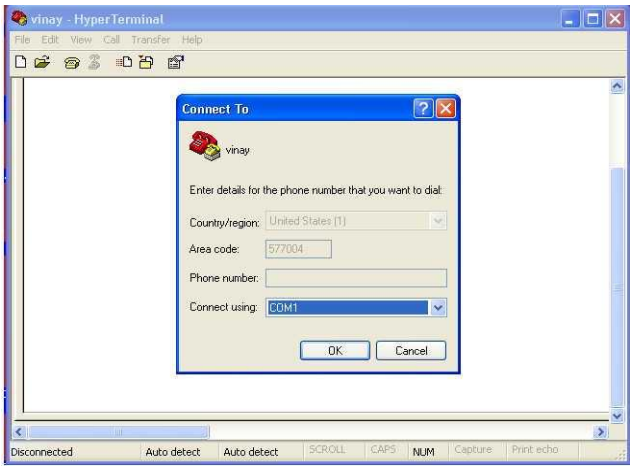

Fig.4: Hyper terminal, selects the communication port to device.

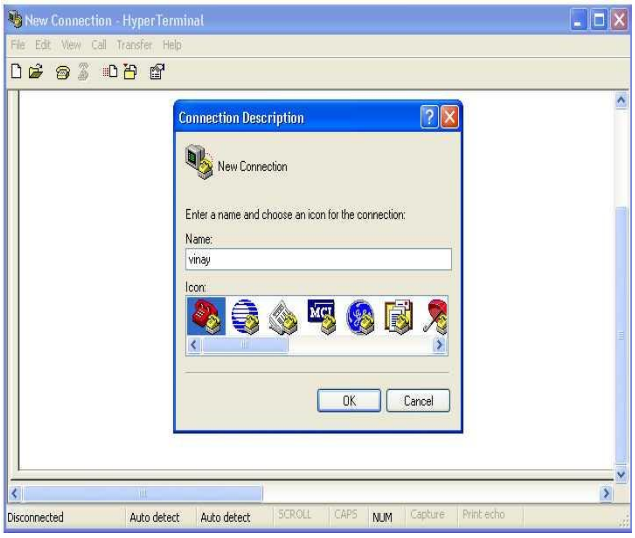

Fig. 5: Selecting com port.

Port settings are all by default or we can select the settings by selecting the port bits per second, data bits, parity, stop bits, flow control.

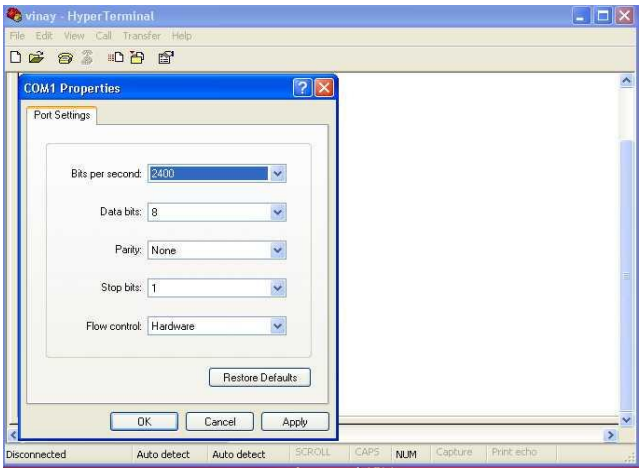

Fig 6: Port setting

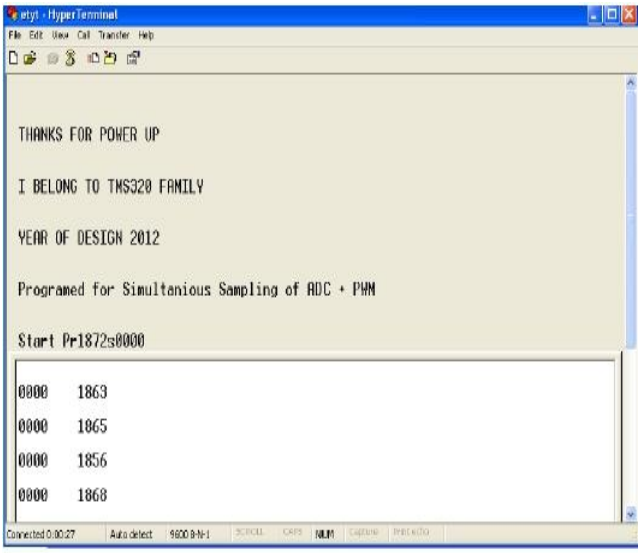

Fig 7: Snapshot showing the output while power on

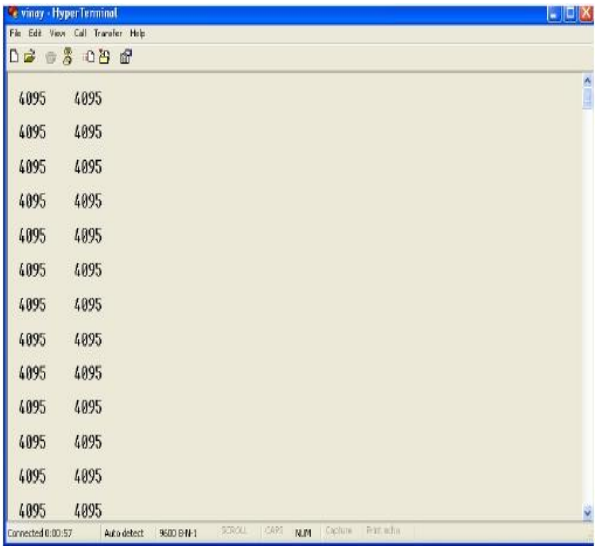

Fig 8: Snapshot showing the system set up output

ISSN: 2278 – 7798

B. Calculation of output voltage

The digital value of the input analog voltage is derived by:

Digital value = 0 when input ≤ 0v

Digital value = $\frac{4095 * \text{Input Analog Voltage} - \text{ADCLO}}{3}$

Digital value= 4095 when input≥ 3v

Suppose digital value = 4095, we can calculate its output voltage by following method,

$$V = \frac{2132*3.3}{4095} = 1.7V$$

From this output voltage with its digital values is calculated and dual channel ADC output is displayed in the result.

VII. CONCLUSION

Project will give an designed and developed control circuit board for Motor control applications. The project has been accomplished with the help of CCS software and EAGLE software for PCB design.

Deployment of Embedded controller boards for controlling and processing application helps in attaining better productivity and good quality at substantially low costs, presence of DSP Processor gives quick and accurate response to the system and also gives the capability to process wide category of inputs and efficient controlling.

REFERENCES

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[6] A Glossary of Analog-to-Digital Specifications and Performance Characteristics.

AUTHORS PROFILE

Vinay kumar T N graduated in B.E Biomedical Engineering from University B.I.E.T College of Engineering Davangere, Karnataka, India in 2009 and Post graduation (M.Tech) in Digital Electronics from G.M.I.T Davanagere, Karnataka, India in 2012. Presently working as a Lecturer in Department of Studies in Electronics and communication engineering at University BDT College of Engineering, Davangere, Karnataka, India.

ISSN: 2278 – 7798