ISSN No. 0976-5697

Volume 4, No. 6, May 2013 (Special Issue)

International Journal of Advanced Research in Computer Science

REVIEW ARTICAL

Available Online at www.ijarcs.info

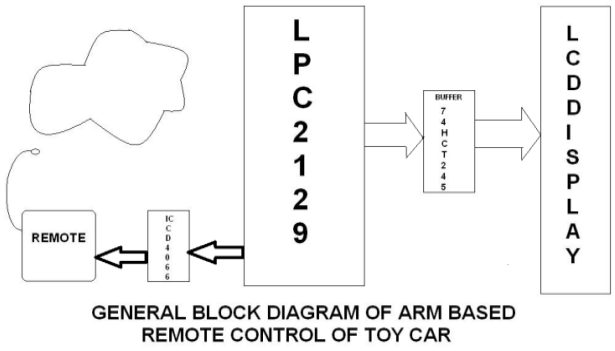
ARM Based Remote control Toy Car

Harish G Langar, Atul P Shinghade, Pavan V Sukode
1S.I.R.T. Bhopal, 2D.B.N.C.O.E.T. Yavatmal,3 Fr.CRCE Bandra Mumbai
harishlangar@gmail.com, atul.p.shingade@gmail.com, psukode@gmail.com

***Abstract*—** With ever increasing popularity of ARM core based microcontroller for embedded systems, So decided to incorporate project utilizing ARM based microcontroller LPC 2129.In this project , ARM based LPC 2129 kit studied & after careful examination of various functions of pins, suitable pins were chosen & necessary hardware were added to develop simple application of remote control of car . A normal control toy car has four keys for controlling forward, reverse, right & left turn motions. At any particular time, only one function can be incorporated and it is observed that car just runs at constant speed and turns abruptly. Our work demonstrates much better control with smoother acceleration and deceleration along with capability to turn while running at lower speed. PWM capability of LPC 2129 utilized to control speed of motor using pulse width modulator. Currently two route paths were programmed for control.LCD display interfaced to kit to indicate present state of car.

I. INTRODUCTION

The ARM7TDMI is a member of the Advanced RISC Machines (ARM) family of general purpose 32-bit microprocessors, which offer high performance for very low power Consumption and pric The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. The ARM7TDMI-S processor also employs a unique architectural strategy known as THUMB, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The ARM7TDMI-S processor has two instruction sets 1) The standard 32-bit ARM instruction set. 2) A 16-bit THUMB instruction set. The THUMB set's 16-bit instruction length allows it to approach twice the density of standard ARM code



GENERAL BLOCK DIAGRAM OF ARM BASED REMOTE CONTROL OF TOY CAR

Figure 1.

II. HARDWARE DESCRIPTION

A. *System Structure :*

Arm based Toy car System consists the CPU unit, which is formed of ARM System interfaced to LCD through Buffer IC 74HCT245 and the Remote control of Toy car. The Remote control of Toy car can be controlled with programming which in c language along Keil software. The Remote control of Toy car connected to ARM with the of IC CD4066 is as shown in Figure 1

B. *Introduction To Lpc2129*

In this project ARM based LPC 2129 microcontroller kit is being used. Along with LPC 2129 microcontroller kit have a 256KB of embedded high speed flash memory.

ARM microcontroller is in 64 pin package. Also it has a 16KB on chip RAM two no. of CAN channels & four no. of 10 bit AD channels. Another main features of this ARM based microcontroller. In-system programming (ISP) and in-application programming (IAP) via on-chip boot-loader software. Two 32-bit timers, PWM unit (6 outputs).Multiple serial interfaces including two UART.60 MHZ maximum CPU clock available from programmable on-chip phase-locked loop. On-chip crystal oscillator with an operating range of 1MHZ to 30MHZ.Two interconnected CAN interfaces with advanced acceptance filters. Dual power supply CPU operating voltage range of 1.65V to 1.95V .I/O power supply range of 3V to 3.6V

a. *Registers In Lpc 2129 Microcontroller:*

Different types of registers are available for external interrupts, Timer 0&1, A/D converters, GPIO, PWM, UART 0&1, CAN etc. In this project PWM, GPIO, pin connect block registers are being used for the speed control application of Toy car. The purpose of the pin connect block is to configure microcontroller pins to the desired functions

The PINSEL0 register controls the functions of the pins as per the settings listed in Table

Table: 1

PINSEL 0	Pin Name	Function when 00	Function when 01	Function when 10	Function when 11
1:0	P0.0	GPIO Port 0.0	TxD (UART0)	PWM1	Reserved
17:16	P0.8	GPIO Port 0.8	TxD UART1	PWM4	Reserved
19:18	P0.9	GPIO Port 0.9	RxD(UART1)	PWM6	EINT3

Concern address used in code PINSEL0 = 0x000A0002

b. *Pulses width modulator (pwm):*

Seven match registers allow up to 6 single edge controlled or 3 double edge controlled PWM outputs, or a

CONFERENCE PAPER
"A National Level Conference on Recent Trends in Information Technology and Technical Symposium" On 09th March 2013
Organized by
Dept. of IT, Jawaharlal Darda Inst. Of Eng. & Tech., Yavatmal (MS), India

mix of both types. An external output for each match register with the following capabilities:

a) Set low on match.
b) Set high on match.
c) Toggle on match.
d) Do nothing on match.

Supports single edge controlled and or double edge controlled PWM outputs. Single edge controlled PWM outputs all go high at the beginning of each cycle unless the output is a constant low. Double edge controlled PWM output can have either edge occur at any position within a cycle. This allows for both positive going and negative going pulses. Pulse period and width can be any number of timer counts. This allows complete flexibility in the trade-off between resolution and repetition rate .All PWM outputs will occur at the same repetition rate. Double edge controlled PWM outputs can be programmed to be either positive going or negative going pulses. Match register updates are synchronized with pulse outputs to prevent generation of erroneous pulses. Software must "release" new match values before they can become effective. May be used as a standard timer if the PWM mode is not enabled. A 32-bit Timer/Counter with a programmable 32-bit Presale. Four 32-bit capture channels take a snapshot of the timer value when an input signal transitions. A capture event may also optionally generate an interrupt.

PWMTCR = 0x09 PWM Timer Counter (PWMTC - 0xE0014008)

The 32-bit PWM Timer Counter is incremented when the Prescale Counter reaches its terminal count.

PWM Prescale Counter Register (PWMPC - 0xE0014010)

The 32-bit PWM Prescale Counter controls division of pclk by some constant value before it is applied to the PWM Timer Counter. The PWM Prescale Counter is incremented on every pclk. When it reaches the value stored in the PWM Prescale Register, the PWM Timer Counter is incremented and the PWM Prescale Counter is reset on the next pclk. PWM Match Registers (PWMMR0 - PWMMR6) The PWM Match register values are continuously compared to the PWM Timer Counter value. When the two values are equal, actions can be triggered automatically. The action possibilities are to generate an interrupt, reset the PWM Timer Counter, or stop the timer. Actions are controlled by the settings in the PWMMCR register.PWM Match Control Register (PWMMCR - 0xE0014014)

The PWM Match Control Register is used to control what operations are performed when one of the PWM Match Registers matches the PWM Timer Counter. The address for concern code is

Table: 2

P31 P28	P27 P24	P23 P20	P19 P16	P15 P12	P11 P8	P7 P4	P3 P0
0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 1 0

PWMMCR = 0x00000002

c. Interfacing of LCD module to the ARM processor:

LCD modules are available in a wide range like 8x1, 8x2, 16x1, 16x2, 20x2, 20x4, 40x4. Here we have used 16x2- that means 2 rows of 16 characters. It is a Hitachi HD44780 compatible module, having 16 pins including 2 pins for backlight. Following table gives pin structure of LCD module. LCD modules without backlight will have only 14 pins. To program the LCD module, first it has to initialize the LCD by sending some control words. RS should be low and E should be high when sending control. R/W pin 0 mean write data or control to LCD and R/W pin 1 means read data from the LCD. To send a data to LCD, make RS high, R/W low, place the data in pins 7 to 14 and make pin E high and low once. Here, to write on the LCD module and not reading back. So, R/W is connected to ground directly. Need not have to input any data through, so all output pins are used in our application. Data pins of LCD are connected to data pins of the port.

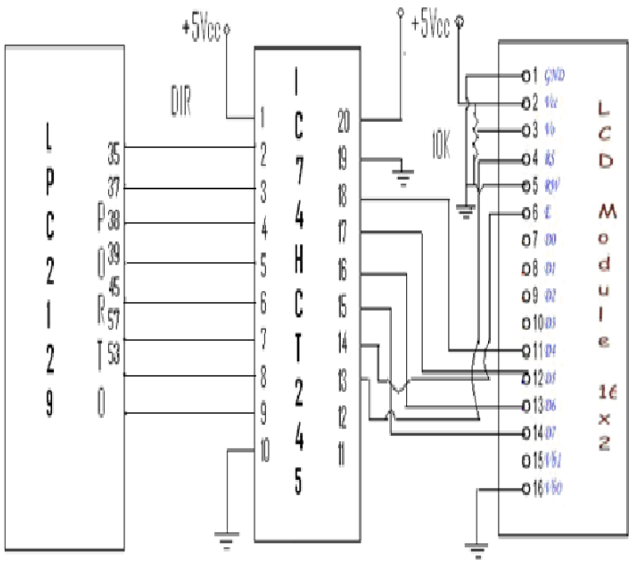


Figure 2.

In the above diagram, LCD module is connected to the port 0 of LPC 2129 through the buffer IC 74HCT245. Pin number 3 of the LCD is for adjusting the contrast, connected in such a way that it can be varied from 0V to 5V. Keep it to 0 initially.

III. SOWFTWARE DESCRIPTION

(a). LPC 2000 FLASH UTILITY
(b). KEIL MICRO VISION

A. Lpc 2000 flash utility:

This flash utility is available for free download from the Philips Website. This software, in combination with the hardware described below, allows for Hands-off erasure, uploading, and execution of code. The Philips LPC2000 Flash utility utilizes two, otherwise unused, signals (RTS and DTR) of the PC serial port to control the microcontroller reset and P0.14 pins. The port pin P0.14, if LOW during reset, puts the microcontroller into In System Programming (ISP) mode, this pin has the alternate functions of external interrupt one and general purpose I/O (GPIO)

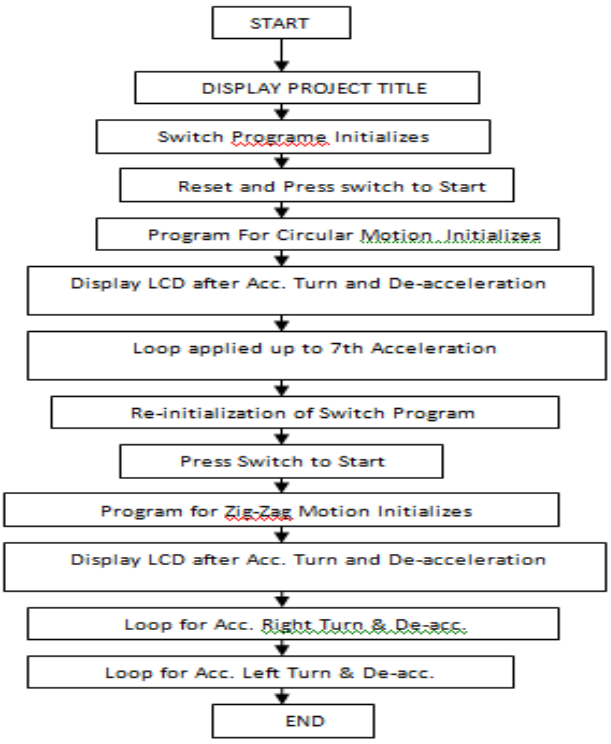
B. Keil Microvision:

In this it will be using an Integrated Development Environment from Keil electronics. This IDE is called micro vision and versions already exist for other popular microcontroller including 8051 and the Infineon C16X family. Micro vision successfully integrates project manager, editor, compiler and debugger in one seamless front-end. Although it is concentrating on LPC2000 family,

the KEIL ARM tool can be used for any other ARM7 based microcontroller. The micro vision development Environment can be used with several different compiler tools. These include the ARM ADS compiler. Micro vision also includes two debug tools. Once the code has been compiled and linked into micro vision simulator. This debugger simulates the ARM7 core and the peripheral of the supported micro. Using the simulator is a very good way of becoming familiar with LPC2000 devices. Since the simulator gives the cycle accurate simulation of the peripheral, as well as CPU, it can be very useful tool for verifying that the chip has been correctly initialized and that the correct values for thing such that timer prescaler values have been calculated. However the simulator can only take it so far and sooner or later it will need to take some inputs from real world. This can be done for certain extent with the simulator scripting language, but eventually it will need to run these codes on real target. The simulator front end can be connected to these hardware's by the keil U link interface. The U link interface connects to the PC via USB and connects to the development hardware by the LPC2000 JTAG interface.

The JTAG interface is the separate peripheral on ARM7.which support debug commands from the host .By using the JTAG it can use the micro vision simulates to have basic run controller of the LPC2000 device. JTAG allows it to download code into the target, to single step and run code at full speed, to set breakpoints and view memory location.

Flowchart



IV. CONCLUSIONS

The main objective is to get familiar with the various powerful features of the ARM LPC2129 based kit and to develop it further with some extra useful peripherals like Alphanumeric LCD display and to implement simple application around it We have been fairly successful in this regard. There are many noteworthy aspects of ARM processor like ADC, Timers, CAN, I 2C interfaces, etc. which can provide a highly sophisticated control and monitoring interface to the user However, it provides the basic concepts for implementation of remote guided vehicle, development of aids for handicapped persons to control their movements on wheel-chair, etc. There is also ample scope to add communications facilities like mobile based remote control application due to presence of inherent UART chip with powerful capability.

V. REFERENCES

[1]. Sardar, Ziauddin, ed. (1999). Rescuing All Our Futures. Praeger Studies on the 21st Century,Westport, Connecticut, USA.

[2]. Slaughter, Richard (2005). The Knowledge Base of Future Studies.

[3]. Zhang Wen, Research on embedded positioning system of vehicle, Manufacturing Automation,Vol 32, pp.152-154, July 2010.

[4]. Wang Lei, Jiang Bing, Chen Wenjian, Design of onboard navigation system based on ARM platform, Microprocessors, Vol 6, pp.104-106, June 2006 .

[5]. Xiang Shuaiqiu, Zhan Shaobin, Jiang Tao, On the main technological schemes and algorithm for vehicle location system, Geospatial information, Vol 6, pp.87-90, June 2008.

[6]. Liu Lei, Jin Zhigang, Tao Chunhua, Survey of virtualization technology research and realization, Geospatial information, Vol 1, pp.175-177,January 2009 .

Short Bio Data for the Author

Harish G. Langar Washim 23 November 1983 Complete full time Bachelor of Engineering (Electronics & Telecommunication Engineering) B.N.C.O.E., Pusad, Maharashtra, Amravati University. Pursuing full time Master of Technology (Electronics & Communicatoion) S.I.R.T. Bhopal, RGPV University Madhayapradesh.

Atul P. Shingade Akola 09 December 1986 Complete full time Bachelor of Engineering (Electronics & Telecommunication Engineering) S.S.G.M.C.E., Shegaon, Maharashtra, Amravati University. Pursuing full time Master of Engineering (Digital Electronics) D.B.N. C.O.E.T. Yavatmal Maharashtra Amravati University

Pavan V. Sukode Digras14 march 1987 Complete full time Bachelor of Engineering (Electronics & Telecommunication Engineering) B.N.C.O.E., Pusad, Maharashtra, Amravati University. Pursuing full time Master of Engineering (Electronics) Fr. CRCE Bandra (west) Mumbai-50 Maharashtra Mumbai University.