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JOURNEY OF MICROCONTROLLER FOR TECNOLOGICAL DEVLOPMENT

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ABSTRACT

A microcontroller is a small and low-cost computer built for the purpose of dealing with various tasks, such as displaying information on seven segment displays at railway platform or receiving information from a television's remote control. They are used in products that require a degree of control to be exerted by the user. Now a day's various types of microcontrollers are available in market with different word lengths such as 8 bit, 16 bit, 32 bit, and 64 bit microcontrollers. Microcontroller is a compressed microcomputer manufactured for controlling the functions of embedded systems in office machines, robots, home appliances, motor vehicles and a number of other gadgets. Therefore in technological development the world do lots of things with the help of Microcontroller. So that all that above microcontrollers applications we have to choose particular types of Microcontroller. The aim of this paper to give the knowledge about technological development of microcontroller and comparative study of 8051 Micro-controller, ARM Microcontroller, PIC Microcontroller, AVR Microcontroller and ARDUINO Microcontrollers.

Keywords: microcontroller, PIC, AVR, 8051, AMR, .memory

I. INTRODUCTION

A Microcontroller is an electronic device which is belonging to the Microcomputer family. These are fabricated using the VLSI technology on a single chip. A Microcontroller is highly integrated chip that contains a CPU, Scratch pad, RAM, Special and general purpose registers, arrays, on chip ROM/Flash Memory for programmed storage, timer and interrupt control units and dedicated I/O ports. Microcontrollers can be considering as super set of Microprocessors so that it contains all the necessary functional blocks for independent working. There are various types of Microcontrollers are available in the market. Following will give the basic idea for the same. Whenever a system is to be implemented using a Microcontroller which is the heart of the device. A Microcontroller is a small device and low-cost computer built for the purpose of dealing with specific tasks. Microcontroller is minicomputer which is used in raspberry pi. The main CISC (complex instruction set computer) architecture which is used to developed modern Microcontroller. Latest Microcontroller are operated at lesser power consumption usually they can support a working voltage of 1.8-5.5v.They are designed and implemented to execute a specific function such as displaying integers or characters on an LCD display ,7 segment display module of a home appliance. These are also present in almost our daily used home appliances, toys, traffic lights, office instruments and various day-to-day appliances. Microcontrollers are designed for embedded applications, in contrast to the Microprocessors used in personal computers as well as other computer. By reducing the size as well as cost compared to a design that uses a separate Microprocessor, input/output devices, and memory Microcontrollers. It makes the devices digitally controlled. Mixed signal Microcontrollers are used for common, integrating analog components needed to control non-digital electronic systems. The test of the manufacturer depends on, a bit of memory, a few A/D converters, timers; input/output lines etc. are added .The easiness of using a Microcontroller and the relatively easy maintenance process also make it more reliable and beneficial.

A. 8051 Microcontroller:

8051 microcontroller was designed in 1980 by Intel. It plays an important role in embedded system. Firstly it creates Nmos technology but Nmos technology consumes more power so it is not beneficial for all of us. Then Intel found the 8051 microcontroller employing Cmos technology and the name was given as 80c51. Then the Cmos technology consumes very less power as compare to Nmos technology. In 8051 microcontroller we used two buses one for data

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and another for program it has two storage room for data and program of 64k by 8 size. Keil application software is used in 8051 microcontroller program by embedded C. Internal functioning Microcontroller 8051 comes with integrated built-in RAM. For storing temporary data prime memory is employed. It is unpredictable memory that is its data can get be lost if the power supply to the Microcontroller switched off. There are total 40 pin are used in 8051 microcontrollers.
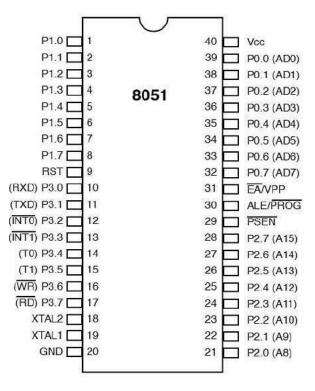

Figure: 8051 Microcontroller

Above fig shows a pin diagram of microcontroller. The microcontroller 8051 applications include large amount of machines, principally because it is simple to incorporate in a project or to assemble a machine around itself.

B.   AVR Microcontroller:
AVR Stands for Alf and Vegard's RISC. AVR is also a type of microcontroller which is developed in 1996 by Atmel but microchip technology acquired Atmel in 2016 but the chip is modified Harvard architecture 8 bit RISC Single chip microcontroller

Figure: AVR Microcontroller

The first AVR line was start from AT90S8515. It have 40 pin DIP packages like as an 8051 microcontroller. It also has two buses one is data bus and another is addressed bus. The polarity of AVR microcontroller is opposite of 8051 microcontroller. In AVR microcontroller has active low RESET but in 8051 microcontroller has active high RESET. And all another's pins are same. The architecture of AVR 8 bit microcontroller was introduced in 1997. AVR Microcontrollers are classified into three types,

a) Tiny AVR – Small size, less memory, suitable only for simpler applications.

b) Mega AVR – These are the most popular ones which are having good amount of memory (up to 256 KB), higher number of inbuilt peripherals also suitable for moderate to complex applications.

c) XMEGA – Used commercially for complex applications, that requires large program memory and high speed.

C. PIC Microcontroller:

Pic microcontroller is also a family of microcontroller. PIC stands for peripheral interface controller it is specialized as microchip technology in Chandlers, Arizo.The peripheral interface controller was developed by microchip in the year 1993 but now a days pic microchip are rarely used the PIC microcontroller chip is designed very compactly so it is very small in size and easy to used it operates in embedded system it is also used in robot, home appliances, medical devices, etc. PIC microcontroller works very fast and the program executing are very easy as compare to another microcontroller. This microcontroller has some special specification that is it includes wide availability ease of programming, serial programing capacity. In PIC Microcontroller CPU includes ALU, Memory unit and accumulator. ALU is used for arithmetic and logical operations.

Figure: PIC Microcontroller

The PIC microcontrollers appeal to experimenters, especially in the fields of electronics and robotics. Architecture PIC microcontroller consists of RAM, ROM, CPU, timers, counters and also supports the protocols such as SPI, CAN, and UART for interfacing with other peripherals. At present PIC microcontrollers are extensively used for industrial purpose for low power consumption, high performance ability and easy of availability of its supporting hardware and software tools like compilers, debuggers and simulators. The advantages of this microcontrollers are consistent and faulty of pic percentage is very low. As compare to other microcontrollers power consumption is very low and programing is very easy.

D. ARDUINO Microcontroller:

Arduino is a microcontroller device. It is an open source electronics platform. It is very easy to use for both software and hardware. The arduino UNO board is totally based on ATmega 328 there are total 14 digital input output pin in which 6 pin can be used as PWM output. It contain 16 MHz ceramic resonator, an ICSP Header, a USB connection, 6 analog input, power jack, also a reset button. These all are supporters of microcontroller. To start the arduino UNO it connects to the computer by using USB cable or AC to DC adaptor. From all other board Arduino UNO varies and they will not use the FTDI USB-to-serial driver chip in them. There are various types of Arduino but most of them were third party compatible version. The official version of arduino UNO is arduino UNO R3 and Arduino Nano V3.
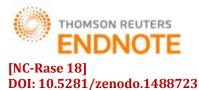

Figure: Arduino Microcontroller

E. ARM Microcontroller:

ARM stands for Acron RISC Machine. The first ARM application was as a second processor and the BBC Micro, where it helped in developing simulation software to finish development of the support chips like VIDC, IOC, MEMC and speed up the CAD software used in ARM2 development. Wilson subsequently rewrote BBC BASIC in ARM assembly language ARM is 32 bit Microcontroller whose core is designed by ARM Limited with RISC architecture. ARM has von Neumann architecture that is (program and RAM in the same space). Architecture versions ARMv3 to ARMv7 support 32-bit space A and 32-bit arithmetic; most architectures have 32-bit fixed-length instructions

Figure: ARM Microcontroller

ARM Microcontrollers are extremely used in power saving and operate in very low power consumption. ARM includes integer arithmetic operations for sub, add and multiply; some versions of the architecture also support divide operations. ARM Microcontrollers Widely used in modern handset for mobile communications. These are also used in various other embedded system likes iPod, hand held gaming unit disk driver and so on. 8051, PIC need multiple clock cycles per instruction. AVR and ARM both execute most instructions in a single clock cycle.

Comparison of Microcontrollers:

Features	8051	PIC	AVR	Arduino	ARM
Bus width	8 bit	8/16/32 bit	8/32 bit	8/16/32 bit	64/128/256/512/10 24 bit
Communication Protocol	UART,USAR T,SPI,12C	PIC,UART, USART,LIN, CAN,ETHERN ET	UART,USART, USB, ETHERNET	UART	UART, USART, LIN, I2C, SPI, CAN, USB, Ethernet, I2S, DSP, SAI, IrDA
Speed	12 clk/instr. cycle	4 clk/inst. cycle	1 clk/inst cycle	16 million inst. cycle	extra millions of inst. per second
Memory	ROM,SRAM, FLASH	SRAM,FLASH	FLASH,SRAM, EEPROM	FLASH	ROM,DRAM,SRA M,SDRAM

ISA	CLSC	RISC	RISC		RISC
Memory Architecture	Von Neumann Architecture	Harvard Architecture	Modified	Harvard Architecture	Von Neumann Architecture
Power Consumption	Average	Low	Low	Low	very low
Families	8051 variant	PIC 16, PIC 17,PIC 18, PIC 24, PIC 32	TINY Atmega,Xmega,S pecial purpose AVR		ARMv4,5,6,7 and series
Community	Vast	Very good	Very good	Good	Vast
Manufacturer	NXP,Atmel,Sil icon,Labs,Dall	Microchip Average	Atmel		Apple, NVidia, Qualcomm,

	as, Cyprus, Infineon, etc.				Samsung Electronics, and TI etc.
Cost	Very low	Average	Average	Low	Low
Other Features	Known for its standard	Cheap	High Speed Operation		High speed operation

II. CONCLUSION

There are different microcontroller products are available in market. It is clear that those devices can be applied to many embedded system designs from the simple hardware control applications to signal processing applications. The choices of devices available today are vast. Hence one must know what type of Microcontroller suitable for particular applications. This paper will help to select a particular Microcontroller for specific applications.

REFERENCES

1. M. A. Mazidi, J.G. Mazidi, R.D. Mckinlay, "The 8051 Microcontroller and Embedded Systems: using Assembly and C", Pearson Education, Inc., 2nd edition 1999.
2. Takawira F., Dawoud D.S., "Selecting the Right Microcontroller Unit", Zimb. J. Sci. Technol., Vol. 4, no. 1, p 39-46
3. Gonzales D.R., "Understanding the Key Architectural Features of a Microcontroller".
4. Gajski, Daniel D., Principles of Digital Design. Englewood Cliffs, NJ: Prentice-Hall, 1997.
5. "Selecting the Microcontroller Unit", Freescale Semiconductor.
6. Technical Guide to Microcontroller Selection, "Microcontrollers: options and trends in today's applications", Wednesday, January 25, 2006
7. Types of Microcontroller: Application note available at: http://my.safaribooksonline.com/book/electrical-engineering/semiconductor-technology/9788131759905/types-selection-and-applications-of-microcontrollers/ch001#X2ludGVybmFsX0h0bWxWaWV3P3htbG lkPTk3ODgxMzE3
8. Selection of a microcontroller: http://my.safaribooksonline.com/book/electrical-engineering/semicon ductor-
9. technology/9788131759905/types-selection-and-applications-o   f-microcontrollers/ch001#X2ludGVybmFsX0h0bWxWaWV3P3htbG lkPTk3ODgxMzE3NTk5MDUlM
9. "Comparison of Microcontroller", Documentation available at [10] "List of Microcontrollers", Software documentation – Available: "http://en.wikipedia.org/wiki/List_of_common_microcontrollers"
10. "Software documentation – Available: http://en.wikipedia.org/wiki/Microcontroller", November, 2009.

11. M. A. Mazidi, R.D. M ckinlay and Danny Causey, 2013, "PIC Microcontroller and Embedded system using Assembly and C for PIC18," Pearson publication.
12. Raj Kamal, 2009, "Microcontroller: Architecture, programming interfacing and system design, "Pearson education."
13. Manas Kumar Parai, Banasree Das, Gautam Das, "An overview of Microcontroller unit: From proper selection to specific application," education, pp.5-7 to specific application," International Journal of soft computing and Engineering, ISSN: 2231-2307, volume-2, Issue-6, January.
14. Rajratna Khadse1, Nitin Gawai2, Bagwan M. Faruk3 "Overview and Comparative Study of Different Microcontrollers" International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 2 Issue XII, December 2014 ISSN: 2321-9655.