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AVR Development Board

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ABSTRACT

Microcontroller is a compressed micro computer manufactured to control the functions of embedded systems in office machines, robots, home appliances, motor vehicles, and a number of other gadgets. A micro controller development board is a printed circuit board containing a micro controller and the minimal support logic needed for an engineer to become acquainted with the microcontroller on the board and to learn to program it.

Microcontroller has a CPU, in addition with a fixed amount of RAM, ROM and other peripherals all embedded on a single chip. At times it is also termed as a mini computer or a computer on a single chip. Today different manufacturers produce microcontrollers with a wide range of features available in different versions. Some manufacturers are ATMEL, Microchip, TI, Freescale, Philips, Motorola etc.

Keywords-- Atmega8/16, LED, LCD, PiezoBuzzer, HEX Keypad, DC Motor, 7 Segment Display, ADC, RS_232, DIP Switches

I. INTRODUCTION

An AVR microcontroller is a type of device manufactured by Atmel. The present single-chip design and application of technology is developing rapidly, the National Higher Academy of Engineering, has been widely opened the microcontroller and related courses. For SCM learning, not just in the classroom learning the theory of knowledge, practice is an essential part, if divorced from theory and practice, the study of the effect will be greatly reduced. Currently, most colleges and universities used to Microprocessor Teaching is the preferred model to explain. But Microprocessor board has many problems like troubleshooting problem, more power consumption, large size, costly, motherboard failure, memory failure, heating problem etc.AVR Development board is solution of above mention problems. A microcontroller is a self-contained system with peripherals, memory and a processor that can be used as an embedded system. The easiest way of thinking about it is to compare a microcontroller with your PC, which has a motherboard in it. On that motherboard is a microprocessor (Intel, AMD chips) that provides the intelligence, RAM and EEPROM memories and interfaces to rest of system, like serial ports, disk drives and display interfaces. A microcontroller has all or most of these features built-in to a single chip, so it doesn't need a motherboard and many components. AVRs are available with 8-pins to 100-pins, although anything 64-pin or over is surface mount only. Most people start with a DIL (Dual In Line) 28-pin chip like the ATmega328 or the 40-pin ATmega16 or ATmega32. PC microprocessors are always at least 32-bit and commonly now 64-bit. This means that they can process data in 32-bit or 64-bit chunks as they are connected to data buses this wide. The AVR is much simpler and deals with data in 8-bit chunks as its data bus is 8-bit wide, although there is now an AVR32 with 32-bit bus and an At-mega family with a 16-bit data bus. A PC has an operating system (Windows or Linux) and this runs programs, such as Word or Internet Explorer or Chrome that do specific things. An 8-bit microcontroller like the AVR doesn't usually have an operating system, although it could run a simple one if required, and instead it just runs a single program. Just as your PC would be useless if you didn't install any programs, an AVR must have a program installed to be any use. This program is stored in memory built-in to the AVR, not on an external disk drive like a PC. Loading this program into the AVR is done with an AVR programmer.

II. METHODOLOGY

2.1 ATMEGA-16:

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz.ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively.ATmega16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided

into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD.ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals. The following table shows the pin description of ATmega16.

2.2 ATMEGA-32:

ATmega32 is very much similar to ATmega16 microcontroller with certain differences which are discussed below.ATmega32 is an 8-bit high performance microcontroller of Atmel's Mega AVR family. Atmega32 is based on RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega32 can work on a maximum frequency of 16MHz. ATmega32 has 32 KB programmable flash memory, static RAM of 2 KB and EEPROM of 1 KB. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000 respectively.

The differences between ATmega32 and ATmega16 can be summarized in Table 1.

Table1: Difference between Atmega16 and Atmega32

Memory	ATmega32	ATmega16
RAM	2 KB	1 KB
Flash	32 KB	16 KB
EEPROM	1 KB	512 bytes

2.3 ATMEGA-8:

The ATMega8 can be a cheaper replacement of the ATMega32. ATMega8 has 28pins in total. Available memories on an Mega8 are as follows:

- 8KB of Flash memory
- 512Bytes of EEPROM
- 1KB Internal SRAM

Available features on a Mega8 chip:

- Two 8bit timer/counter
- One 16bit timer/counter
- Three PWM channels
- Six channel 10bit ADC
- Two wire serial interface (TWI), USART, SP

III. PRIOR APPROACH

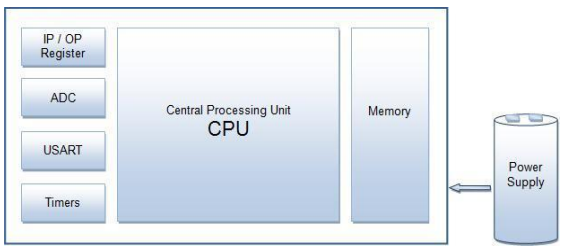

Fig. 1 Architecture of AVR

3.1HARDWARE DESCRIPTION:

3.1.1 LEDs:

Light emitting diodes are semiconductor light sources. The light emitted from LEDs varies from visible to infrared and ultraviolet regions. They operate on low voltage and power. They are used for luminance and optoelectronic application based on semiconductor diodes, LEDs emit photons when electrons recombine with holes on forward biasing. The two terminals of LEDs are anode and cathode and can be identified by their size.

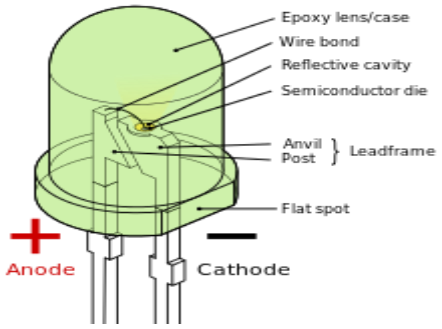

Fig. 2 LED

3.1.2 SEVEN SEGMENT:

A seven segment display is the most basic electronic display device that can display digits from 0 to 9.they find wide application in devices that display numeric information like digital clock, radio, microwave ovens, electronics meters etc.

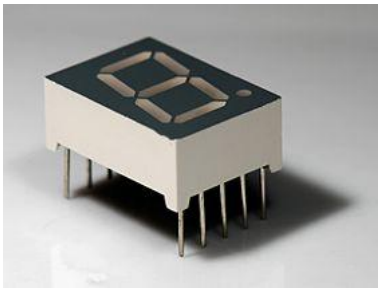

Fig.3 Seven Segment

3.1.3 LCD:

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines in this LCD each character is displayed in 5x7 pixels matrix. This LCD has two registers namely command and data. The command register store the command instructions given to the LCD. The data register stores the data to be displayed on the LCD.

Fig. 4 LCD

3.1.4 PUSH-ON SWITCH:

A push-on switch is momentary or non-latching switch which causes a temporary change in the state of an electrical circuit only while the switch is physically actuated. An automatic mechanism returns the switch to its default position immediately afterwards, restoring the initial circuit condition.

Fig. 5 Push On Switch

3.1.5 DC MOTOR:

An electric motor is a machine which converts electrical energy into mechanical energy. It is based on the principle that when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force whose direction is given by Fleming's left hand rule and whose magnitude is given by force

F = BIL

Fig. 6 DC Motor

3.1.6 DTMF:

DTMF is a signalling system for identifying the keys or better say the number dialled on a pushbutton or DTMF keypad. The early telephone system used pulse dialling or loop disconnects signalling. This was replaced by multi frequency dialling. DTMF is a multi frequency tone dialling system used by pushbutton keypads in telephone and mobile sets to convey the number or key dialled by the caller.

Fig. 7 DTMF

3.1.7 PIEZO BUZZER:

Piezo buzzer is an electronic device commonly used to produce sound. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator, computers, call bells etc.

Fig. 8 Piezo Buzzer

3.1.8 RELAY SWITCH:

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate.

Fig. 9 Relay Switch

3.1.9 HEX- KEYPAD:

Keypad is widely used input device with lots of application in our everyday life. From a simple telephone to keyboard of a computer, ATM, electronic lock etc. keypad is organized as a matrix of switches in rows and column. The article used 4x3 matrix keypad and a 16x2 LCD.

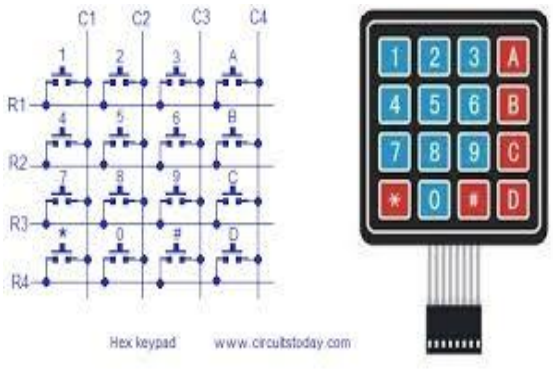

Fig. 10 Hex Keypad

***3.2 POWER SUPPLY*:** Since all electronic circuit work only with low dc voltage. We need a power supply unit to provide the appropriate voltage supply. This unit consists of battery, rectifier, filter and regulation.

3.3 *PIN DIAGRAMS*:

3.3.1 ATMEGA-16 :

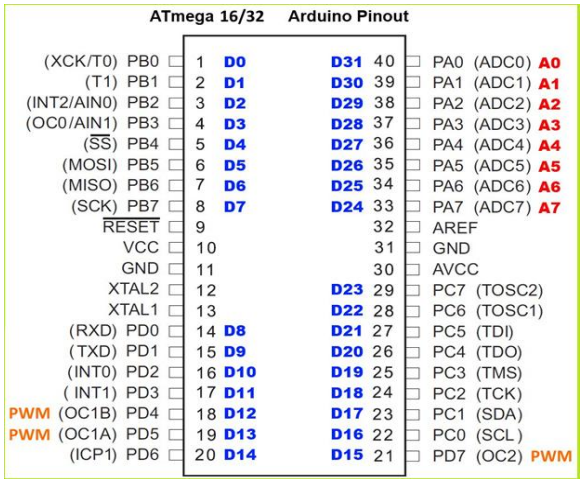

Fig. 11 Pin Configuration of Atmega_16

Note: Pin diagram of Atmega-16 & 32 are similar.

3.3.2 ATMEGA-8:

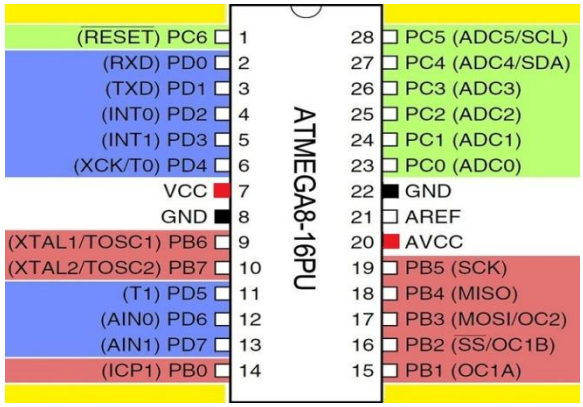

Fig. 12 Pin Configuration of Atmega-8

IV. OUR APPROACH

The presented system is designed and configured for practical use. The system is able to control any machinery or home appliances. The system will respond to each state according to a specific program which is coded and installed in the microcontroller.

The portability is an important parameter of the system. The system which can be worn and used by the subject for prolonged time is considered as a portable system; otherwise it is regarded as non-portable. The easiness of the system usage is considered as another parameter. An easy to use device is actually easy to get to and an easy to function. Finally the non-invasive utilization of the system is considered as a property of the system.

4.1 ADVANTAGES:

- Low design time.
- Low production cost.
- Setting the destination is very easy.
- It is dynamic system.
- Less space.
- Low power consumption.

V. CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION:

A simple, cheap, configurable, easy to handle electronic system has been made. The system is designed, implemented, tested, and verified. The real-time results of the system are encouraging. The system is able to control any machinery or home appliances. The system will respond to each state according to a specific program which is coded and installed in the microcontroller.

Students and researchers will find this board very useful to learn basic embedded systems and communication theories by conducting lab exercises and other experiments. Although a lot of effort and time has gone into the design of the board and then further testing of the hardware, the board is still in a stage where future work needs to be done. Major effort was made in the initial design of the board, including the selection of hardware and other design related components.

5.2 FUTURE SCOPE:

The further work in this thesis may include the manufacture of the board and performing direct tests on the communication and peripheral modules on the board. We are going to ask several Universities, Engineering colleges etc. to include this board in their syllabus. Students should learn its working and can implement it into anything. Microcontrollers have very wide range of applications. This board will lead automation in modern society. It will serve as a base for students to work on the different data communication modules and peripherals test the data rates using serial UART and I/O pins.

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