PIC MICROCONTROLLER 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: PIC16F877A, PIC18F4550, LED, LCD, PiezoBuzzer, HEX Keypad, DC Motor, 7 Segment Display, RS_232, DIP Switches.

I. INTRODUCTION

An PIC 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.PIC 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. PIC devices range from 6-pin SMD, 8-pin DIP chips upto 144-pin SMD chips. Most people start with a DIL (Dual In Line) 28-pin chip like the PIC18F4550 or the 40-pin PIC16F877A. 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 PIC is much simpler and deals with data in 8-bit chunks as its data bus is 8-bit wide. 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 PIC 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, aPIC must have a program installed to be any use. This program is stored in memory built-in to the PIC, not on an external disk drive like a PC. Loading this program into the PIC is done with aPIC programmer.

II. METHODOLOGY

2.1 PIC16F877A:

The PIC microcontroller PIC16f877A is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have many application in digital electronics circuits.

PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and in many industrial instruments. An EEPROM is also featured in it which makes it possible to store some

of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy. Its flexible and can be used in areas where microcontrollers have never been used before as in coprocessor applications and timer functions etc.

HOW TO PROGRAM THE INPUT AND OUTPUT PORTS OF PIC16F877A

As we have studied 5 input and output ports namely PORTA, PORTB, PORTC, PORTD and PORTE which can be digital as well as analog. We will configure them according to our requirements. But in case of analog mode, the pins or the ports can only act as inputs. There is a built in A to D converter which is used in such cases. Multiplexer circuits are also used.

But in digital mode, there is no restriction. We can configure the ports as output or as input. This is done through programming. For PIC the preferable compiler is mikro C pro which can be downloaded from their website.

There is a register named as 'TRIS' which controls the direction of ports. For different ports there are different registers such as TRISA, TRISB etc.

- If we set a bit of the TRIS register to 0, the corresponding port bit will act as the digital output.
- If we set a bit of the TRIS register to 1, the corresponding port bit will act as the digital input.

2.2 PIC18F4550:

The PIC18F is one of the families of **pic microcontrollers** and PIC18F4550 is its member. PIC18F4550 is one many of the advanced microcontrollers from the microchip era. This microcontroller is very famous in between hobbyist and beginners due it functionalities and functions along with ADC and USB integration. There are different packages like DIP, QPF, and QPN of PIC18F4550 which are currently available.

FEATURES OF PIC18F4550:

- **NANO WATT GENERATION:** PIC18F4550 is an 8-bit microcontroller. PIC18F4550 has been applied with NANO WATT technology, therefore, it requires very low strength for its operation. Some of the important features of this microcontroller are:
- **ALTERNATE RUN MODES:** When cocking the controller by timer1 source or any internal oscillator block, the power can be reduced during execution of code up to 90%.
- **MULTIPLE IDLE MODES:** It has the advantage of working even when its CPU disabled but peripherals being active. The power can be reduced up to 4% in these states.
- **ON-THE-FLY MODE SWITCHING:** It is the power managed modes which referred by user code during operation. It allows the user to implement different ideas of power-consumption into their design of application software.
- **LOW CONSUMPTION IN KEY MODULES:** The Timer1 and watchdog both have low power requirements.
- **UNIVERSAL SERIAL BUS:** The PIC18F4550 implements complete features universal serial bus communications module supporting low-speed and full-speed communication with any type of data transfer. It also has its own on-chip transceiver and 3.3V regulator supporting the use of external transceiver and voltage regulators.

- **MULTIPLE OSCILLATOR OPTIONS AND FEATURES:** The devices in PIC18F4550 supports twelve different options of the oscillator which makes the user have a range of choices for developing any application hardware. These options are:
- Four crystal modes the use of crystals or ceramic resonators.
- 4 external clock modes, imparting the choice of using two pins (oscillator enter and a divide with the aid of-4 clock output) or one pin (oscillator input, with the second one pin, reassigned as fashionable I/O).
- an inner oscillator block which affords an 8 MHz clock (±2% accuracy) and an INTRC source (about 31 kHz, stable over temperature and Voo), in addition to a range of 6 person-selectable clock frequencies, between a hundred twenty-five kHz to four MHz, for a total of eight clock frequencies. This feature releases an oscillator pin for use as a further well-known object I/O.
- A phase lock loop (PLL) frequency multiplier, available to each the high-velocity crystal and outside oscillator modes, which lets in an extensive range of clock speeds from 4 MHz to 48 MHz
- Asynchronous dual clock operation, allowing the USB module to run from a high-frequency oscillator whilst the relaxation of the microcontroller is clocked from an inner low-power oscillator.

The PIC18F4550 consists of up to 13 channels for analog to digital converter. The converter accuracy quantities to ten-bit to

convert analog to digital sign particularly. It is well matched to work with unique inner and outside clock resources. It comes with 4 built-in timers or an external oscillator may be interfaced for clocking. The frequency range is from 31 kHz to 48 MHz respectively. The microcontroller PIC18F4550 comes with ADC comparators and different such peripherals.

III. PRIOR APPROACH

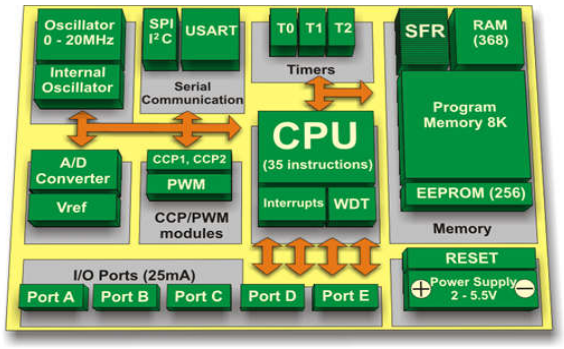

Fig. 1 Architecture of PIC

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.

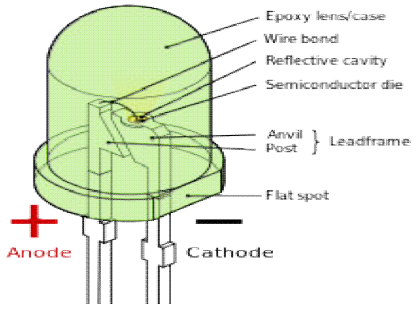

Fig. 2 LED

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 numericinformation like digital clock, radio, microwave ovens, electronics meters etc.

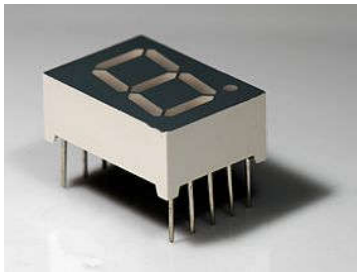

Fig.3 Seven Segment

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.

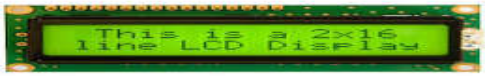

Fig. 4 LCD

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.

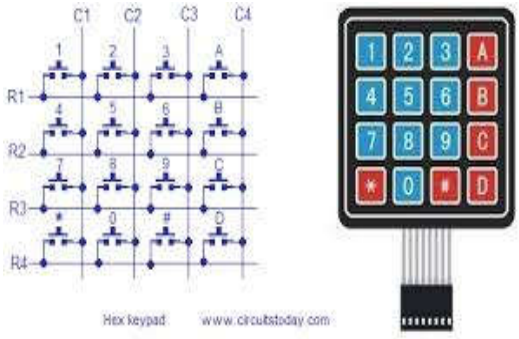

Fig. 10 Hex Keypad

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 PIC16F877A :

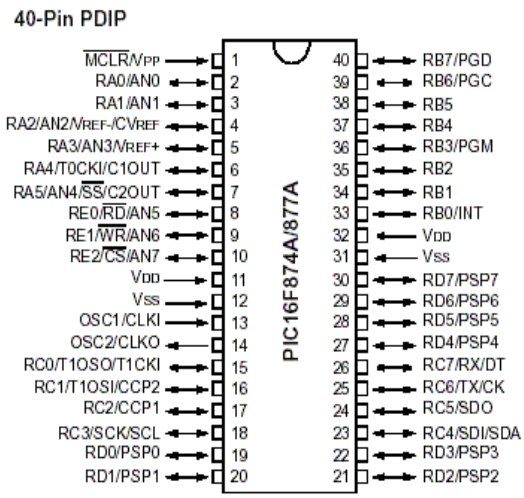

Fig. 11 Pin Configuration of PIC16F877A

3.3.2 PIC18F4550:

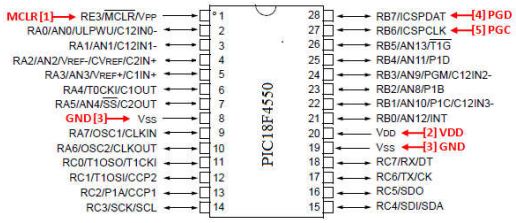

Fig. 12 Pin Configuration of PIC18F4550

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.

II. 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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