



**WATER QUALITY MONITORING
SYSTEM USING WIFI MODULE
PROJECT REPORT**



Submitted by

KARTHIK.G

Reg No.:13BEC063

KARTHIKA.M

Reg No.:13BEC066

PAVITHRA.D

Reg No.:13BEC100

RAMARAHAVENDAR.A

Reg No.:13BEC120

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BONAFIDE CERTIFICATE

Certified that this project report“WATER QUALITY MONITORING SYSTEM USING WIFI MODULE” is the bonafide work of **Mr.KARTHIK.G[13BEC064]**, **Ms.KARTHIKA.M[13BEC066]**, **Ms.PAVITHRA.D [13BEC100]**, **Mr.RAMARAHAVENDAR.A[13BEC120]**who carried out the project work under my supervision.

SIGNATURE

Ms.V.Uma Maheswari M.E.,(Ph.D),

PROJECT SUPERVISOR

Department of ECE

Kumaraguru College of Technology

Coimbatore-641049

SIGNATURE

Dr. K.Malarvizhi M.E., Ph.D,

HEAD OF THE DEPARTMENT

Department of ECE

Kumaraguru College of Technology

Coimbatore- 641049

The candidates with Register No: 13BEC063, 13BEC066, 13BEC100, 13BEC120 are examined by us in the project viva-voce examination held on

.....

INTERNAL EXAMINAR

EXTERNAL EXAMINAR

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ABSTRACT

Water pollution is one of the important problem. To prevent the water pollution, first we have to estimate the water parameters like pH, temperature and level of the water , as the variations in the values of these parameters point towards the presence of pollutants. At present, water parameters are detected by chemical test or laboratory test, where the testing equipments are stationary and samples are provided to testing equipments. Thus the current water quality monitoring system is a manual system with tedious process and is very time consuming. In order to increase the frequency, the testing equipments can be placed in the river water and detection of pollution can be made remotely. This project proposes a Sensor-Based Water Quality Monitoring System.

The system architecture consists of data monitoring nodes, a base station and a remote station. All these stations are connected using wireless communication link. The data from nodes is send to the base station consisting of PIC microcontroller designed for special compact space application. Data collected by the base station such as pH, temperature and water level is sent to the remote monitoring station. Data collected at the remote site can be displayed in visual format on a server PC with the help of MPLAB software and is also compared with standard values. If the obtained value is above the threshold value automated warning SMS alert will be sent to the mobile using wifi module. The uniqueness of our proposed project is to obtain the water monitoring system with high frequency, high mobility, and low powered

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LIST OF ABBREVIATIONS

WSN	Wireless Sensor Network
GUI	Graphical User Interface
LCD	Liquid Crystal Display
WIFI	Wireless Fidelity
PIC	Peripheral Interface Control
RISC	Reduced Instruction Set Computer
CISC	Complex Instruction Set Computer
MSSP	Master Synchronous Serial Port
SPI	Serial peripheral Interface
I [^] C	Integrated Circuits
CCP	Capture/Compare/PWM module
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
EEPROM	Electrically Erasable Programmable Read Only Memory

1.INTRODUCTION:

1.1.Water pollution:

Access to water is one of the present Global issues of the current century. Water pollution causes contamination in large scale water bodies which is considered to be the immediate threat today. Excess of contaminants are discharged directly or indirectly into water bodies. Water pollution affects plants and creatures living in the water. Water Pollution is a major global problem which requires ongoing valuation and modification of water resource guiding principle at the levels of international down to individual wells. It has been surveyed that water pollution is the leading cause of deaths and diseases worldwide. The records show that more than 14,000 people die daily worldwide. In India predictable 580 people die of water pollution related illness every day. In many developing countries, dirty or contaminated water is being used for drinking without any proper former treatment.

1.2.Reason for Water pollution:

One of the reasons for this situations is the unawareness of public and administration and the lack of water quality monitoring system which creates serious health issues. Also natural phenomena such as volcanoes, algae tints, rainstorms, and earthquakes also change the quality and ecological status of water. Water quality monitoring is one of the first steps required in the rational development and management of water resources. Thus , we describe the design of Wireless Sensor Network (WSN) that helps to monitor the quality of water with the help of information sensed by the sensors immersed in water, so as to keep the water resource within a standard described for domestic usage and to be able to take necessary actions to restore the health of the degraded water body. Using different sensors, this system can collect various parameters from water, such as temperature, pH, oxygen density, turbidity and so on.

Approach to real-time data acquisition, transmission and processing is the major phase of the project. The clients can get ongoing water quality

information according to their convenience on a large scale access. In a system of this kind, there are several nodes, a base station and a remote monitoring station. Each node contains a group of sensors and the nodes which are circulated in distinctive water bodies. Data collected by sensor nodes is sent to the base station via WSN channel and proceeding to the remote monitoring station. The remote monitoring station is usually a PC with Graphic User Interface (GUI) for users to evaluate water quality data.

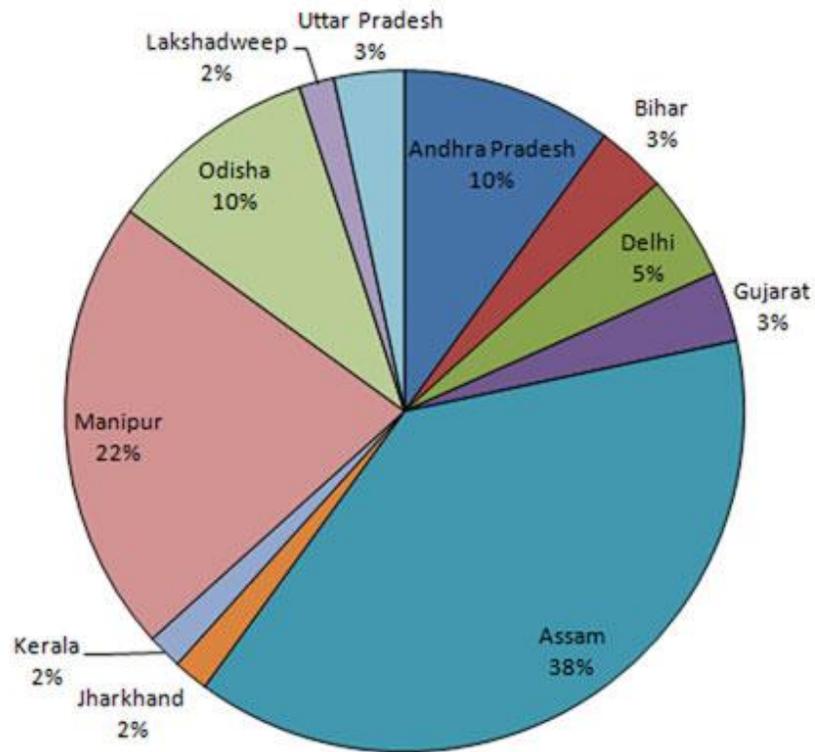


Fig:1.1-Percentage wise data of pond water monitoring stations presents in different states and union territories of India.

1.3. Report of Water Monitoring stations:

The water quality monitoring system for major rivers indicates that organic pollution is predominant and almost all the surface water are contaminated to some extent by Coliform Group of Bacteria that make them unfit for human consumption. The grossly polluted rivers are Sabarmati, Godavari, Satluj, Yamuna, Cauvery, Ganga, Krishna, Tapi, Mahanadi and Brahmani whereas relatively under maintenance are Mahi, Narmada, Brahmaputra and Beas with respect to organic and bacterial pollution. The growth of monitoring network is depicted every year in Fig:1.2 .The monitoring process takes place in rivers,lakes,tanks,ponds,creeks,canals& drains every month and on half yearly basis in case of ground water.

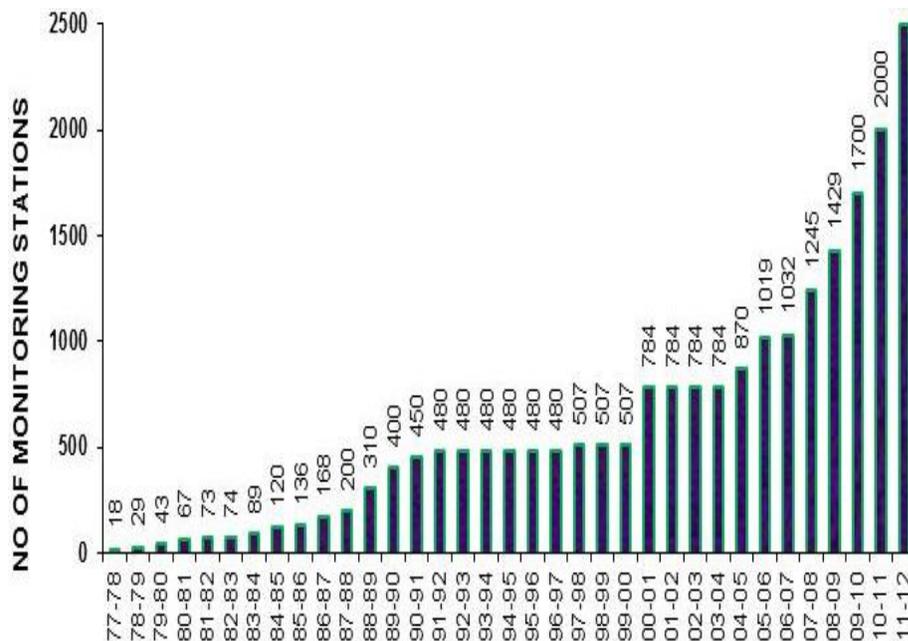


Fig:1.2-Year wise growth of water quality monitoring network

2.HARDWARE DESCRIPTION:

2.1.PROJECT DESCRIPTION:

The main aim of this project is to check the quality of the water using the sensors such as pH, temperature and level sensor. pH is the important parameter to check the salt level of the drinking water. Temperature sensor and level sensors are the additional water quality parameters used to check the temperature and water level in a tank. PIC microcontroller which enables the sensors to read the parameter values. In addition to monitoring the parameter values of water, the results can be transmitted through wifimodule. A mandatory webpage is created which can be accessed from any device and results are interfaced to be updated in the webpage, ensuring devices are connected to the particular hotspot.

BLOCK DIAGRAM WATER MONITORING SYSTEM:

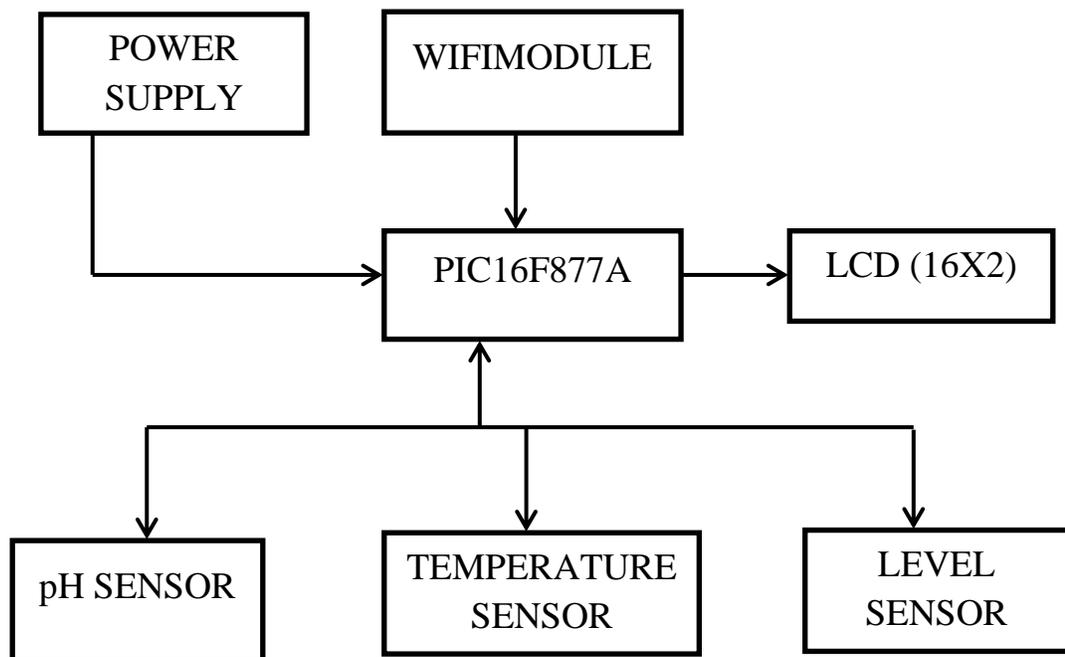
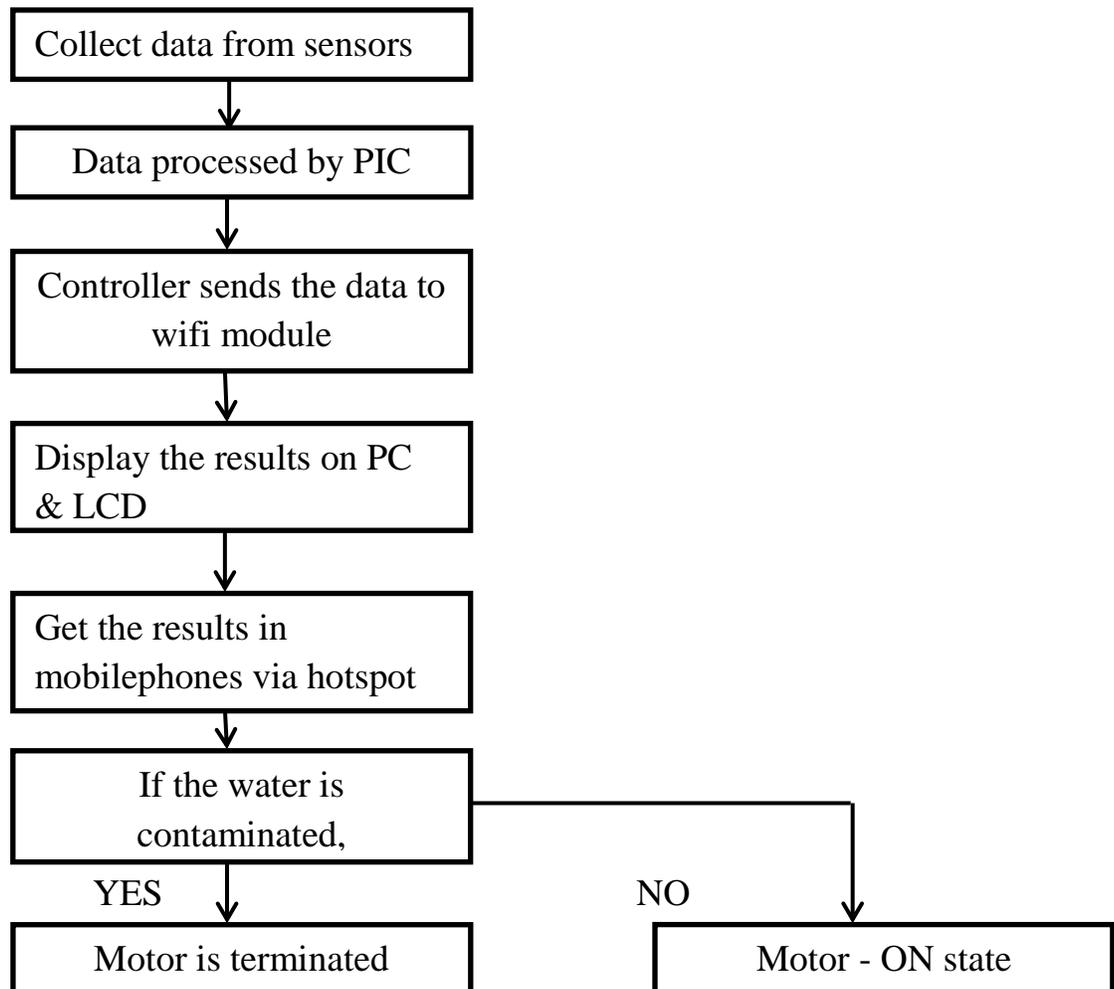


Fig: 2.1-Block Diagram of water monitoring system

The Block diagram shown in Fig:2.1 using stepdown transformer is connected to PIC microcontroller, the sensors are connected as input of the PIC controller. The sensor values are read by the PIC microcontroller and these values are display in LCD display. Wifi module is interfaced with the PIC controller which receives the parameters values. The webpage is created using the Xamp server and programmed by php coding.The temperature,level and pH values are updated instantly. MPLAB is used to program the PIC controller and PROTEUS is used to simulate the results. The motor is an additional feature interfaced to the controller to indicate the immediate existence of contaminated water.

2.2.PROJECT EXECUTION FLOW:



2.3.COMPONENTS AND ITS USES:

Table.No:1 Components and its uses.

COMPONENTS	USES
pH SENSOR	Salt level
TEMPERATURE SENSOR	Temperature level
LEVEL SENSOR	Water level in tank
WIFI MODULE	Display the results on PC and mobilephones using hotspot.
PIC MICROCONTROLLER	Performance for various real time applications
MOTOR	ON/OFF control
LCD DISPLAY	To display the results

The description of the components we used in this project is explained below,

- PIC Microcontroller - PIC16F877A
- Temperature Sensor - LM35
- Level Sensor - IR
- LCD display - 16x2
- Wifi module - ESP8266
- Motor - Stepper

Features of PIC16F877A:

High-performance RISC CPU

- Operating speed : 20 MHZ , 200 ns instruction cycle.
- Operating voltage:4.0-5.5volts.
- Industrial temperature range: -40 to +85 degrees.
- 15 Interrupt sources.
- 35 Single word instructions.
- All single - cycle instructions except for program branches.

Special Features

- Flash memory:14.3 KB(8192 words).
- Data SRAM : 368 bytes
- Data EEPROM : 256 bytes.
- Self - reprogrammable under software control.
- In - circuit serial programming via two pins.
- Watchdog timer with on- chip RC oscillator.
- Programmable code protection.
- Power - saving code protection.
- Selectable oscillator options.
- In - circuits debug via two pins.

Peripheral Features

- 33 I/O pins : 5 I/O ports.
- Timer 0: 8-bit timer/counter with 8-bit prescaler.
- Timer 1: 16-bit timer/counter with prescaler.
- Timer 2: 8-bit timer/counter with 8-bit period register ,prescaler and postscaler..

Analog Features:

- 10 - bit , 8 - channel A/D coverter.
- Brown – out reset.
- Analog comparable module.

CMOS Technology:

- Low-power, high-speed Flash/EEPROM technology.
- Fully static design.
- Wide operating voltage range (2.0V to 5.5V).
- Commercial and Industrial temperature ranges.

2.5.PIN DIAGRAM:

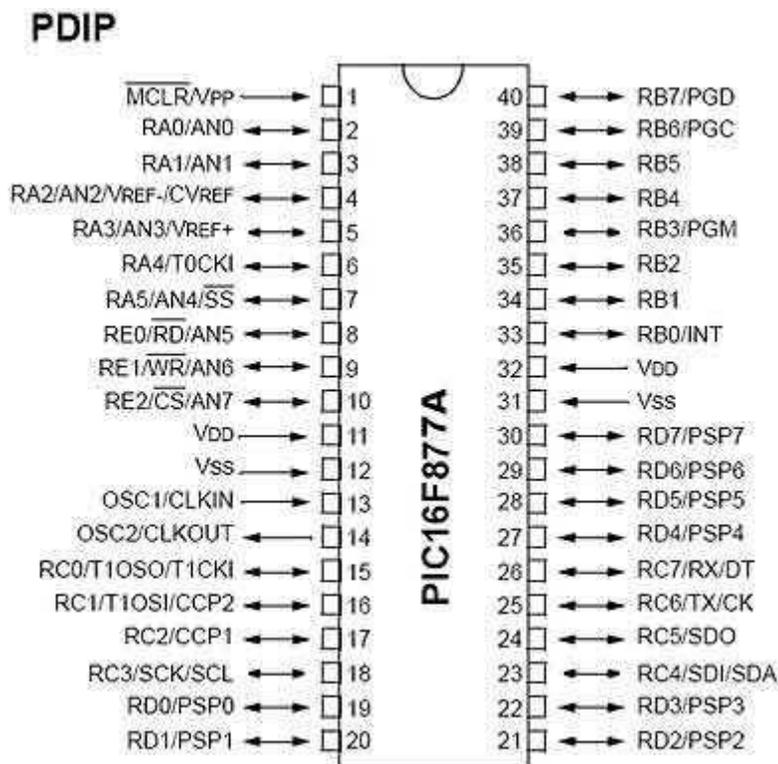


Fig:2.3-Pin Diagram of PIC16F877A

PIN 1: MCLR

The first pin is the master clear pin of this IC. It resets the microcontroller and is active low, meaning that it should constantly be given a voltage of 5V and if 0 V are given then the controller is reset. Resetting the

controller will bring it back to the first line of the program that has been burned into the IC.

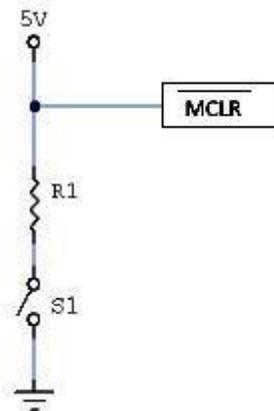


Fig:2.4-Master Clear pin

A push button and a resistor is connected to the pin. The pin is already being supplied by constant 5V. To reset the IC the button is pushed and MCLR turns to 0.

PIN 2:RA0/AN0

PORT A consists of 6 pins, from pin 2 to pin 7, all of these are bidirectional input/output pins. Pin 2 is the first pin of this port. This pin can also be used as an analog pin AN0. It is built in analog to digital converter.

PIN 3: RA1/AN1

This can be the analog input 1

PIN 4: RA2/AN2/Vref-

It can also act as the analog input2. Or negative analog reference voltage can be given to it.

PIN 5: RA3/AN3/Vref+

It can act as the analog input 3. Or can act as the analog positive reference voltage.

PIN 6: RA0/T0CKI

When timer0 the pin acts as the clock input pin, the type of output is open drain.

PIN 7: RA5/SS/AN4

It can be the analog input 4. There is synchronous serial port in the controller also and this pin can be used as the slave select for that port.

PIN 8: RE0/RD/AN5

PORT E starts from pin 8 to pin 10 and this is also a bidirectional input / output port. It can be the analog input 5 or for parallel slave port it can act as a 'read control' pin which will be active low.

PIN 9: RE1/WR/AN6

It can be the analog input 6. And for the parallel slave port it can act as the 'write control' which will be active low.

PIN 10: RE2/CS/A7

It can be the analog input 7, or for the parallel slave port it can act as the 'control select' which will also be active low just like read and write control pins.

PIN 11 and 32: VDD

These two pins are the positive supply for the input/output and logic pins. Both of them should be connected to 5V.

PIN 12 and 31: VSS

These pins are the ground reference for input/output and logic pins. They should be connected to 0 potential.

PIN 13: OSC1/CLKIN

This is the oscillator input or the external clock input pin.

PIN 14: OSC2/CLKOUT

This is the oscillator output pin. A crystal resonator is connected between pin 13 and 14 to provide external clock to the microcontroller. $\frac{1}{4}$ of the frequency of OSC1 is outputted by OSC2 in case of RC mode. This indicates the instruction cycle rate.

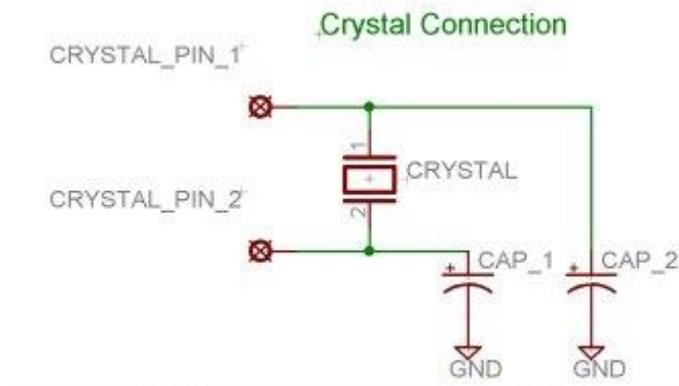


Fig:2.5-Oscillator

PIN 15: RC0/T1OCO/T1CKI

PORT C consists of 8 pins. It is also a bidirectional input output port. Among them, pin 15 is the first. It can be the clock input of timer 1 or the oscillator output of timer 2.

PIN 16: RC1/T1OSI/CCP2

It can be the oscillator input of timer 1 or the capture 2 input/compare 2 output/ PWM 2 output.

PIN 17: RC2/CCP1

It can be the capture 1 input/ compare 1 output/ PWM 1 output.

PIN 18: RC3/SCK/SCL

It can be the output for SPI or I2C modes and can be the input/output for synchronous serial clock.

PIN 23: RC4/SDI/SDA

It can be the SPI data in the pin or in the I2C mode, it can be data input/output pin.

PIN 24: RC5/SDO

It can be the data out of SPI in the SPI mode.

PIN 25: RC6/TX/CK

It can be the synchronous clock or USART Asynchronous transmit pin.

PIN 26: RC7/RX/DT

It can be the synchronous data pin or the USART receive pin.

PIN 19,20,21,22,27,28,29,30

All of these pins belong to PORT D which is again a bidirectional input and output port. When the microprocessor bus is to be interfaced, it can act as the parallel slave port.

PIN 33-40: PORT B

All these pins belong to PORT B. Out of which RB0 can be used as the external interrupt pin and RB6 and RB7 can be used as in-circuit debugger pins.

2.6.OVERALL ARCHITECHTURE OF PIC16F877A:

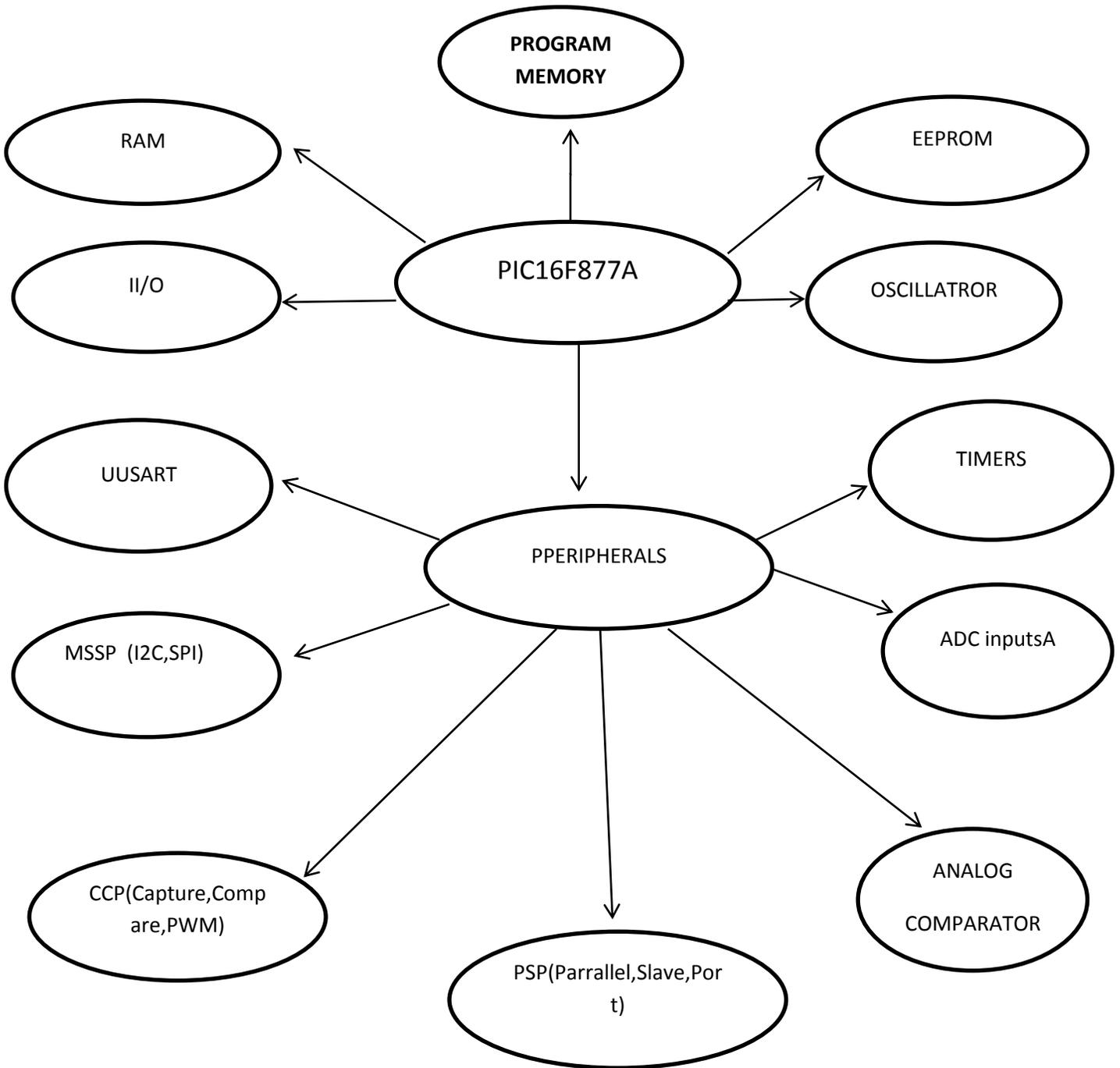


Fig:2.6-Architecture of PIC16F877A

MEMORY ARCHITECTURE:

PIC uses program and data memory and it is used mostly in RISC CPU'S. Its data memory (RAM) has a small number of 8-bit registers. The data memory is partitioned into General Purpose registers and Special Function Registers. The Program memory (ROM) has a 12-bit, 14-bit or 16-bit registers.

CISC:

Traditionally, CPU's are "CISC"

- CISC means Complex Instruction Set Computer (CISC) .
- Used in: 80X86, 8051, 68HC11, etc.
- It has many instructions (usually > 100).
- It also has many addressing modes.
- Usually takes more than 1 internal clock cycle to execute.

RISC:

PICs and most Harvard chips are "RISC"

- RISC means Reduced Instruction Set Computer (RISC)
- Used in: SPARC, ALPHA, Atmel AVR, etc.
- It has few instructions (usually < 50.)
- It has only a few addressing modes.
- Executes 1 instruction in 1 internal clock cycle .

MEMORY FEATURES:

- High performance RISC CPU with 35 no. of instruction set .
- Harvard Architecture.
- Pipelined Instructions.
- 8kB of flash program
- 256-EEPROM data memory
- 15 Interrupts
- In-circuit programming

- 3 internal hardware timers
- Capture/Compare/PWM modules
- Up to 8 channels of 10-Bit A/D
- Built-in USART for serial communication
- 5 digital I/O ports (Up to 22 lines).

OSCILLATOR:

It produces a periodic and oscillating waveform. Oscillators mainly convert DC from a power supply to AC signal. Oscillator works at a certain frequency, which is usually determined by quartz crystal.

For PIC16F877A, Oscillators have upto 4 different modes:

LP->Low Frequency Crystal.

XT->Crystal/Resonator.

HS->High Speed Crystal/Resonator.

RC->External Resistor/Capacitor.

LP:

- Selects the lowest gain setting for the internal inverter-amplifier.
- Lowest current consumption of the three modes.
- Designed to drive a 32.768 KHZ crystal.

XT:

- Selects the intermediate gain for the internal inverter-amplifier.
- Typically selected for crystals in the range of 4 MHZ or lower.

HS:

- Selects the highest gain setting for the internal inverter-amplifier.
- Typically used with crystals above the 4 MHZ range.

RC:

- It requires an external resistor and capacitor to set the oscillator frequency.
- Each mode is optimized for a different frequency range.

OPERATION:

The crystal connected to the OSC1 and OSC2 pins of micro-controller. It will also require capacitors on the range of 15pf-30pf.

I/O PORTS:

The PIC 16F877A has five I/O Ports and the total of 33 pins are used for I/O operations.

PORT A:

- Port A is 6 bit wide and bi-directional.
- Its corresponding data direction register is TRISA.
- If TRISA port pin is set to 1, corresponding port A pin will act as an input pin and vice versa.
- Port A is used for analog inputs.

PORT B:

- Port B is 8 bit wide and bi-directional.
- Corresponding data direction register is TRISB.
- If TRISB port pin is set to 1, corresponding port B pin will act as an input pin and vice versa.
- Port B is used for Data Transmission.

PORT C:

- Port C is 8 bit wide and bi-directional.
- Its corresponding data direction register is TRISC.
- If TRISC port pin is set to 1, corresponding port C pin will act as an input pin and vice versa.

- Port C is used for control registers (serial communication, I2C functions, serial data transfer)

PORT D:

- Port D is 8 bit wide and bi-directional.
- Its corresponding data direction register is TRISD.
- If TRISD port pin is set to 1, corresponding port D pin will act as an input pin and vice versa.
- Port D is used as Data port.

PORT E:

- Port E is 3 bit wide . They are for read, write and chip select operation.
- Each pin is individually configurable as inputs and outputs.
- Port E is generally used for controlling purposes.

MSSP :

The Master Synchronous Serial Port (MSSP) module is a serial interface. It is useful for communicating with other peripheral or microcontroller devices.

The MSSP module can operate in one of two modes:

- Serial Peripheral Interface(SPI).
- Inter-Integrated Circuit(I²C).

CCP:

Capture/Compare/PWM (CCP) module contains a 16-bit register which can operate as a:

- 16-bit Capture register
- 16-bit Compare register
- PWM Master/Slave Duty cycle register

CAPTURE MODE:

In the Capture mode, CCP captures the 16-bit value of the TMR1 register when an event occurs on pin RC2/CCP1. The type of event is configured by control bits.

An event is defined as one of the following:

- Every falling edge
- Every rising edge
- Every 4th rising edge
- Every 16th rising edge

COMPARE MODE:

In the Compare mode, the 16-bit CCPR1 register value is constantly compared against the TMR1 register pair value. It has some specification according to their pin configuration.

When a match occurs, the RC2/CCP1 pin is:

- Driven high
- Driven low
- Remains unchanged

PWM MODE:

Steps to set the PWM pin,

1. Set the PWM period by writing to the PR2 register.
2. Set the PWM duty cycle by writing to the CCPR1L register and CCP1CON bits.
3. Make the CCP1 pin an output by clearing the TRISC bit.
4. Set the TMR2 prescale value and enable Timer2 by write in T2CON.
5. Configure the CCP1 module for PWM operation.

PSP:

1. The Parallel Slave Port (PSP) allows 8-bit asynchronous bidirectional data transfer between the PIC and external devices, such as other microcontrollers or personal computer.

2. The PSP can directly interface microprocessor data bus. The external microprocessor can read or write the PORT D latch as an 8-bit latch.

TIMERS:

PIC16F877A has 3 Timers,

Timer 0 - 8 bit can be used as a Timer/counter

Timer 1 – 16 bit can be used as a Timer/counter

Timer 2 – 8 bit Timer can be used as the PWM time-base

TIMER 0:

- 8-bit Timer/Counter.
- Readable and writable.
- 8-bit software programmable pre-scaler.
- Internal or external clock select.
- Interrupt on overflow from FFh to 00h.
- Edge select for external clock.

Table.No:2 Timer 0.

7	6	5	4	3	2	1	0
RBPU	INTEDG	TOCS	TOSE	PSA	PS2	PS1	PS0

TIMER 1:

- 16-bit Timer/Counter with two 8-bit register TMR1H/TMR1L.
- Readable and writable.
- Software programmable prescaler upto 1:8.

- Internal or external clock select .
- Interrupt on overflow from FFFh to 00h.

Table.No:3 Timer 1.

7	6	5	4	3	2	1	0
-	-	TICKPS 1	TICKPS 0	TIOSCE N	TISYN C	TMRIC S	TMR1O N

TIMER 2:

- 8-bit Timer/Counter
- Readable and writable.
- Software programmable prescaler upto 1:16.
- Interrupt on overflow from FFh to 00H.

Table.No:4 Timer 2.

7	6	5	4	3	2	1	0
-	TOUT PS3	TOUT PS2	TOUT PS1	TOUT PS0	TMR2 ON	T2CK PS1	T2CK PS0

USART:

Universal synchronous, asynchronous receiver transmitter is also known as a serial communication interface. USART can be configured in the following modes:

- Asynchronous - FULL DUPLEX
- synchronous - HALF DUPLEX

SERIAL COMMUNICATION:

- For serial Communication, the SFR (special function register) involved are TXSTA, TXREG, RCSTA,,RCREG and SPBRG.
- SPBRG is used to set the required baud rate.
- In TXSTA, TXEN is set high to enable transmission.

- The transmitted data is stored in a temporary buffer ,TXREG.
- In RCSTA, SPEN and CREN are set high to enable reception.
- The received data is stored in a temporary buffer, RCREG.

ADC INPUTS:

- PIC16F877A has an inbuilt Successive Approximation ADC which is multiplexed among 8 input pins.
- The A/D module has high and low-voltage reference input that is software selectable to some combination of VDD, VSS,RA2 or RA3.

Table.No:5 ADC Inputs.

ADC CHANNEL	PIC16F877A PIN	PIN FUNCTION
0	RA0	AN0
1	RA1	AN1
2	RA2	AN2/VREF-
3	RA3	AN3/VREF+
4	RA5	AN4
2	RE0	AN5
3	RE1	AN6
4	RE2	AN7

Fig:2.5-Pin configuration of PIC and ADC channel

ADVANTAGES OF PIC16F877A:

- Program is very easy when compare to other microcontrollers.
- Performance is very fast because of using RISC architecture.
- It is very reliable.
- Malfunctioning of PIC percentage is very less.
- Coding is very efficient.
- High clock speed.

APPLICATIONS OF PIC16F877A:

- Remote Sensors.
- Security and safety devices.
- Home Automation.
- Many industrial instruments.

2.7.CIRCUIT DESCRIPTION

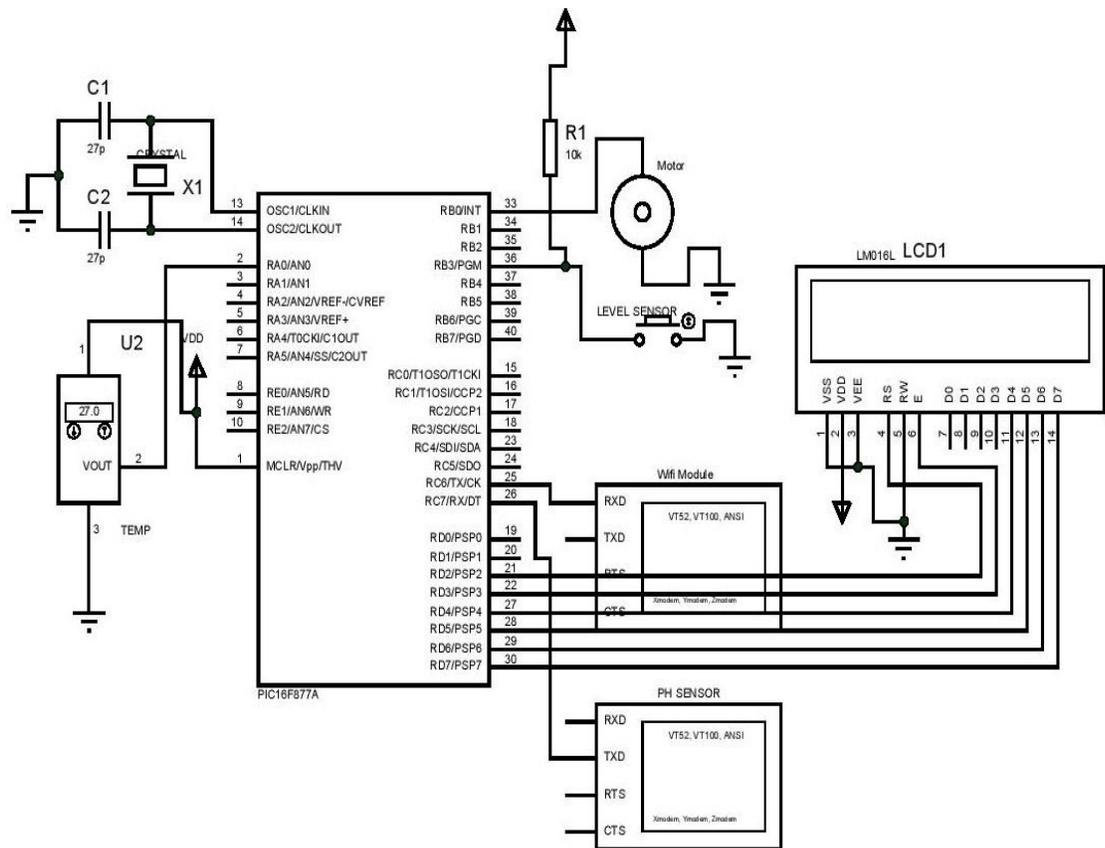


Fig:2.7-Circuit Description of the project

The crystal oscillator is given as input for PIC16F877A ,and the temperature sensor takes an input of 5V from VCC and connected to RA0 pin in the PIC Microcontroller. The level sensor is connected to RS0 pin indicates the amount of water filled in the tank. The overflow of the water is indicated. pH sensor indicates the salt content in the water connected to RC7

pin. The results are displayed in LCD(16x2) connected through the data lines in the PIC Microcontroller. The further indication of contaminated water is observed through the motor connected to RB0 pin. Motor automatically shuts down in the presence of contaminated water. Wifi module is the important feature connected to RC6 pin which receives the process data and transmits the devices connected in the network(hotspot).PC displays all the result values through the local hotspot webpage.

2.8.INTERFACES:

2.9.SENSORS:

In this project we have use three sensors to monitor the quality of the water such as pH sensor , Temperature sensor and Level sensor.

2.9.1.pH SENSOR :

pH is a measure of the acidity or alkalinity of a water solution. The acidity or alkalinity of a water solution is determined by the relative number of hydrogen ions (H⁺) or hydroxyl ions (OH⁻) present. Acidic solutions have a higher relative number of hydrogen ions, while alkaline (also called basic) solutions have a higher relative number of hydroxyl ions. Acids are substances which either dissociate (split apart) to release hydrogen ions or react with water to form hydrogen ions. Bases are substances that dissociate to release hydroxyl ions or react with water to form hydroxyl ions.

Measurement of pH:

pH measurement is based on the use of a pH sensitive electrode (usually glass), a reference electrode, and a temperature element to provide a temperature signal to the pH analyzer. The pH electrode uses a specially formulated, pH sensitive glass in contact with the solution, which develops a potential (voltage) proportional to the pH of the solution. The reference electrode is designed to maintain a constant potential at any given temperature, and serves to complete the pH measuring circuit within the solution. It provides a known reference potential for the pH electrode. The

difference in the potentials of the pH and reference electrodes provides a millivolt signal proportional to pH.

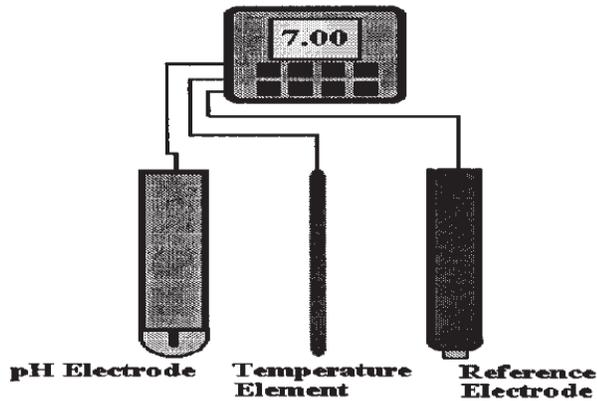


Fig:2.8-pH sensor configuration

2.9.2.TEMPERATURE SENSOR:

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.

Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies.

Features of lm35:

- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full -55°C to 150°C Range
- Operates from 4 V to 30 V

CIRCUIT OPERATION OF LEVEL SENSOR:

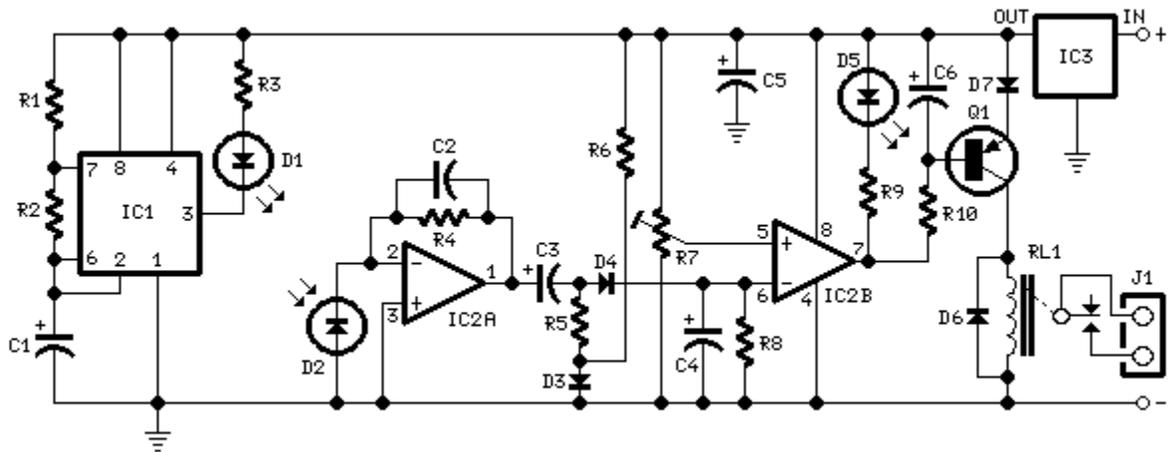


Fig:2.10-Circuit Description of Level sensor

IC1 forms an oscillator driving the infra-red LED by means of 0.8msec. Pulses at 120Hz frequency and about 300mA peak current. D1 & D2 are placed facing the target on the same line, a couple of centimeters apart, on a short breadboard strip. D2 picks-up the infra-red beam generated by D1 and reflected by the surface placed in front of it.

The signal is amplified by IC2A and peak detected by D4 & C4. Diode D3, with R5 & R6, compensates for the forward diode drop of D4. A DC voltage proportional to the distance of the reflecting object and D1 & D2 feeds the inverting input of the voltage comparator IC2B. This comparator switches on and off the LED and the optional relay via Q1, comparing its input voltage to the reference voltage at its non-inverting input set by the Trimmer R7.

Features of IR sensor:

- Output Voltage is proportional to liquid level.
- No moving parts.
- Measures large changes in water.
- Low cost with volume pricing.

2.11.WIFI MODULE:

In this project we use wifi module ESP8266 to get the sensor results from PIC to mobile phones via hotspot. The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or off loading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your device and get about as much WiFi -ability as a WiFi Shield offers . The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

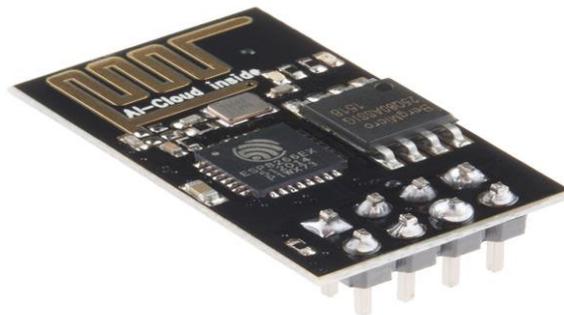


Fig:2.11-Wifi module (ESP8266)

This module is powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

Features of WiFi module:

- It supports 802.11 b/g/n.
- Operating frequency is 2.4 GHz.
- Power consumption is less than 1.0 mW.
- Operating temperature range is -40C~125C

2.12.LCD DISPLAY:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications.It is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. Because,

- LCDs are economical;
- Easily programmable;

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 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc.

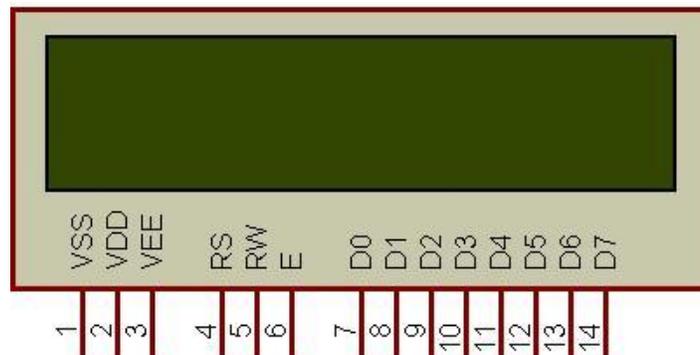


Fig: 2.12-LCD DISPLAY

2.12.1.PIN DESCRIPTION:

Table.No:7 LCD Pin Description.

PIN NO	FUNCTION	NAME
1	Ground(0V)	Ground
2	Supply Voltage,5V	VCC
3	Contrast adjustment ,through a variable resistor	VEE
4	Selects command register when low and data register when high.	Register Select
5	Low to write to the register; High to read from register.	Read/Write
6	Sends data pins when a high to low pulse is given.	Enable
7	8-bit data pins	DB0
8	8-bit data pins	DB0
9	8-bit data pins	DB0
10	8-bit data pins	DB0
11	8-bit data pins	DB0
12	8-bit data pins	DB0
13	8-bit data pins	DB0
14	8-bit data pins	DB0
15	Backlight VCC(5V)	LED +
16	Backlight Ground(0V)	LED -

2.13.MOTOR:

A stepper motor is used in this project to begin the water flow of the tank. It also interface with the PIC microcontroller. Motor will be run only if the sensor's values are in the correct level that means water shouldn't be contaminated. Same as motor will be OFF when water is contaminated.

3.SOFTWARE DESCRIPTION:

3.1.MPLAB:

MPLAB X IDE is a software program that runs on a PC (Windows, Mac OS, Linux) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE), because it provides a single integrated "environment" to develop code for embedded microcontrollers.

Unlike previous versions of the MPLAB IDE which were developed completely in-house, MPLAB X IDE is based on the open source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily, while also providing us with a much more extensible architecture to bring you even more new features in the future.

Features:

- It supports “One-Click”.
- Provides a new Call graph for navigating complex codes
- Supports Multiple Configurations within our projects.
- Supports multiple versions of the same compiler.
- Support for multiple debug tools of the same type.
- Support live parsing.
- Supports hyperlinks for fast navigation to declarations and includes.
- Supports live code Templates.
- Supports the ability to enter File ode templates with license headers or template code.

3.2.PROTEUS:

It is a software suite containing schematic, simulation as well as PCB designing.

ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation.

ARES is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components. The designer can also develop 2D drawings for the product.

Features:

- ISIS has wide range of components in its library.
- It has sources, signal generators, measurement and analysis tools like voltmeter, ammeter and oscilloscope.
- ARES offers PCB designing up to 14 inner layers, with surface mount and through hole packages. It is embedded with the foot prints of different category of components like ICs, transistors, headers, connectors and other discrete components.

3.3.XAMP SERVER:

XAMP is a light-weight easy to install bundle that will allow you to do local development on websites in case you don't have a server hosted already. XAMP consists of the three main things that we need to know when starting web development.

1. Apache Web Server
2. PHP
3. My SQL

APACHE WEB SERVER:

It is a web server that allows you to host your websites or any other content for that matter. Apache is available for UNIX as well as WINDOWS. Some of the most common server-side languages supported by Apache are - PHP, Python and Perl. It is free of charge.

PHP:

A server-side programming language which is used to produce dynamic web pages. PHP code can be embedded within HTML. It is also free and platform-independent which means that it can be installed on any operating system.

MYSQL:

It is the world's most popular open source database. It is a Relational Database Management System (RDBMS) - data and its relationships are stored in the form of tables that can be accessed by the use of MySQL queries in almost any format that the user wants.

3.4.SIGNIFICANCE OF THE PROJECT:

Using PIC microcontroller sensor readings are obtained by interfacing PIC with sensors. Then the results will be send to wifi module which will display the results on the webpage and on LCD also the results will be displayed. Then by using hotspot we can get the results on our mobilephones. Based on the results only we can monitor the quality of the water. The motor will be run only if water is not contaminated. So our main aim of this project is to monitor the quality of the water using some important parameters.

3.5.ENHANCEMENTS OF THE PROJECT:

The existing project is used to monitor the quality of the water.The further development can be made , by using web server an application to control the water flow is created.That is by simply controlling the water flow from anywhere and by adding some additional features, we can improve this project to monitor the quality of ground water.Next big step of the project is to convert contaminated water into uncontaminated water.

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3.6.ALGORITHM OF THE PROJECT:

1. An input of 5v from Vcc is withdrawn by the temperature sensor and connected to RA0 pin in the PIC Microcontroller .
2. The level sensor is connected to RC0 pin. The overflow of water is indicated by level sensor.
3. pH sensor is connected to RC7 pin. pH sensor indicates the salt content in the water . The results are displayed in LCD (16*2) connected through the data lines in the PIC Microcontroller .
4. The further indication of contaminated water is observed through the motor connected RB0 pin . Motor automatically shuts down in the presence of contaminated water.
5. Using MPLAB and PROTEUS software we can program the PIC microcontroller .
6. XAMP server is used to obtain the simulation results.

3.7.ALGORITHM OF THE PROGRAM:

Initialize the LCD ,then the LCD displays the project title.

1. The pH value in water is obtained from pH sensor and are displayed on LCD.
2. The value of water level is indicated by IR sensor whether it is “FULL” or “EMPTY” and displayed on LCD.
3. The temperature sensor senses the temperature value and it will be displayed on the LCD.
4. Using XAMP server and PHP coding , we can obtain the parameter values of sensors on PC.
5. The motor will turn ON intially and turns off only during the detection of contaminated water.
6. Incase of detecting only pure water the motor remains operational until the circuit is OFF

4. WORKING MODEL OF WATER QUALITY MONITORING SYSTEM

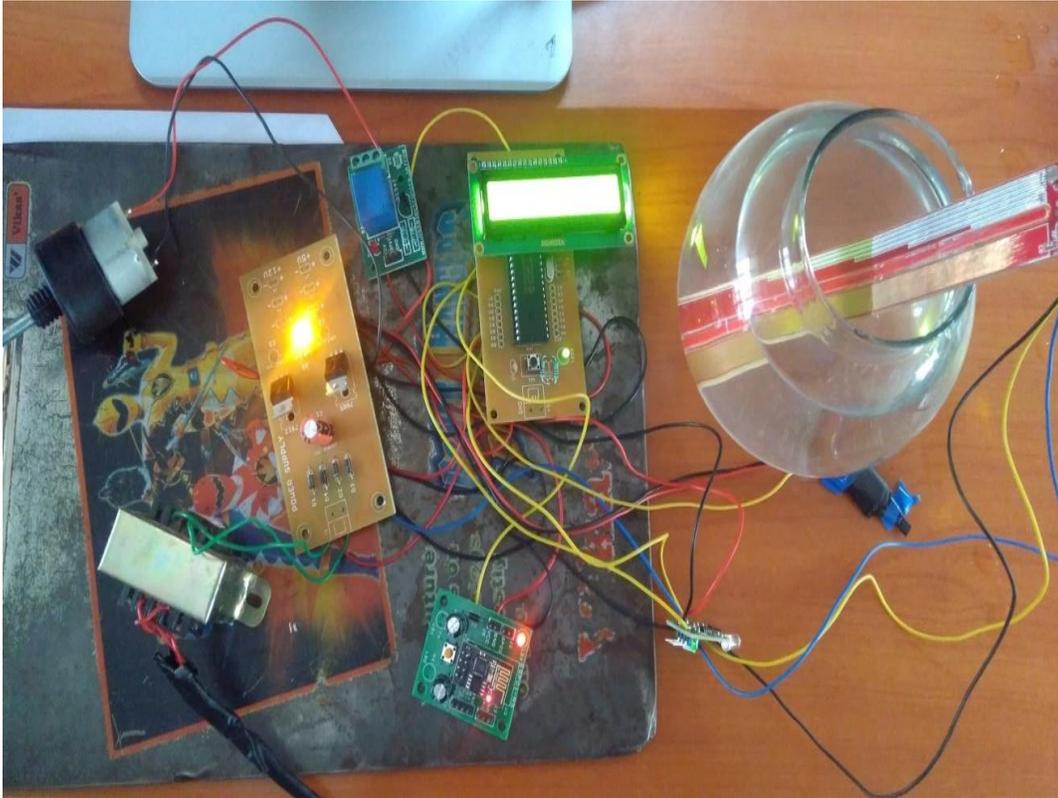


Fig:2.13.Working Model.

4.2.SIMULATION RESULTS:

Simulation results of uncontaminated water:

Ph level	Water level	Temperature	Time
00.00	E	31	2017-04-06 09:55:25am
00.00	E	31	2017-04-06 09:55:31am
00.00	E	31	2017-04-06 09:57:27am
00.00	F	31	2017-04-06 09:57:33am

Fig:2.15- Simulation results of uncontaminated water

Simulation results of contaminated water:

Ph level	Water level	Temperature	Time
4.570	E	31	2017-04-06 10:04:14am
4.800	E	31	2017-04-06 10:04:23am
4.870	E	31	2017-04-06 10:04:33am
4.930	E	31	2017-04-06 10:04:44am
4.930	E	31	2017-04-06 10:04:55am

Fig:2.16- Simulation results of contaminated water

5. CONCLUSION AND FUTURE WORK:

This paper addresses about developing an efficient wireless sensor network based water quality monitoring system, which examines “water quality”, an important factor as far as, irrigation, domestic purposes, industries etc are concerned. Water pollution can be easily detected by this system, which will help in controlling it. Overall the proposed execution of wifi based wireless sensor network for water quality monitoring system offering low power utilization and low cost is presented. Another important fact of this system is the easy installation of the system that is the base station can be placed at the local residence close to the target area and the monitoring task can be done by any person with very less training at the beginning of the system installation.

Future work will deploy more nodes to provide long-term monitoring. Besides, as the water quality parameters correlation between each other, adding data fusion functions and fuzzy control model, which will greatly improve the accuracy of the system monitoring, it will be the next step in the direction of system development. Performance modelling is also one important aspect in different environment to be studied in the future as different kind of monitoring application requires different arrangement during system installation.

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