CHAPTER 1

INTRODUCTION

Over the past decade, online water quality monitoring has been widely used in many countries known to have serious issues related to environmental pollution. The water is limited and essential resource for industry, agriculture, and all the creatures existing on the earth including human being. Any imbalance in water quality would severely affect the health of the humans, animals and also affect the ecological balance among species. In the 21st century there were lots of inventions, but at that time were pollutions, global warming and so on are also being formed, because of this there is no safe drinking water for the world's population. The drinking water is more precious and valuable for all the human beings so the quality of water should be monitored in real time. Nowadays water quality monitoring in real time faces challenges because of global warming, limited water resources, growing population, etc. Hence, there is a need of developing better methodologies to monitor the water quality parameters in real time.

Therefore, various water quality parameters such as dissolved oxygen (DO), conductivity, and turbidity should be monitored in real time. The water quality parameter dissolved oxygen (DO) is indicated the oxygen that dissolved in water. It makes the drinking water taste better. The conductivity indicates the ability of water to pass an electrical current. In water it is affected by various dissolved solids such as chloride, nitrate, sulfate, sodium, calcium, etc. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. The deterioration of water resources becomes a common human problem.

The traditional methods of water quality monitor involve the manual collection of water sample from different locations. These water samples tested in the laboratory using the analytical technologies. Such approaches are time consuming and no longer to be considered efficient. Moreover, the current methodologies include analysis of various kinds of parameters of water quality such as physical and chemical. Traditional methods of the water quality detection have the disadvantages like complicated methodology, long waiting time for results, low measurement precision and high cost. Therefore, there is a need for continuous monitoring of water quality parameters in real time.

By focusing the above issues, we have to develop and design a low-cost water quality monitoring system that can monitor water quality in real time using IOT environment. In our proposed system water quality parameters are measured by the different water quality monitoring sensors such as turbidity, conductivity and dissolved oxygen. These sensor-values are processed by the PIC microcontroller and these processed values are sent to the ESP8266 Wi-Fi module.

1.1 AIM

Project consists of two function unit:

1. To design the system which monitors water quality parameter using sensors.
2. To design the system which store the measured parameters and displays those parameters on any device which has internet facility.

1.2 OBJECTIVE

1. To monitor the water quality in real time to ensure safe supply of water.
2. To monitor the water quality by measuring various water quality parameters such as dissolved oxygen, conductivity, and turbidity using various sensor.
3. To perform real time water quality monitoring by using Internet of things.

CHAPTER 2

LITERATURE SURVEY

This section provides a literature review of existing water quality monitoring system as follows:

NazleeniSamihaHaron, MohdKhuzaimi B Muhammad, Izzatdin Abdul Aziz, MazlinaMehat“**A System Architecture for Water Quality Monitoring System Using Wired Sensors,”[1]** developed a water quality monitoring system for eliminating cost consuming jobs of manual monitoring. In this system the measured data of water quality monitoring sensors are collected by the data kit which gives data to the data processing unit through GSM modem. In data processing unit the data from different sensors are differentiated and it is continuously compared with the ideal parameters of the sensor value. If the water isn't meeting its quality parameter value the alert signal is there which is connected to the buzzer. This system is not reliable for long distance also it will apply to only single unit of water source.

Fiona Regan, Antóin Lawlor and Audrey McCarthy, "Smart Coast Project– Smart Water Quality Monitoring System",[2] designed smart water quality monitoring system. In that system they made water quality smart sensors so the sensors send data wirelessly to the device which collects data from all the nodes. This data is given to the remote server through GPRS network and user can see data remotely. This system is highly scalable, faster and user friendly, but it is costly because of smart sensors. Furthermore, the size of sensors is not reliable for water tap.

ZulhaniRasin and Mohd Rizal Abdullah, “Water Quality Monitoring System Using Zigbee Based Wireless Sensor Network,”[3] developed a water quality monitoring system using ZigBee based wireless sensor network. In proposing system, the sensors are connected to a single circuit which is connected to the Zigbee ZMN2405HP module. The receiver side ZigBee is connected to the PC that shows the GUI of the network circuit. In this system the high-power ZigBee is used and it can be applied to small area network, also the base station is necessary for data storage.

AN Ning, AN Yu, "A Monitoring System ForWaterQuality,"[4].designed monitoring system for water quality. In this system the water quality sensors collect data, from industrial water and municipal water storage, are gathered at the sub-station at which the data are processed. This processed data are sent to the main station through Ethernet networks running on TCP/IP and from the main station that data is again differentiated and given to the environment department and public department using the internet. This system has increased data accuracy, reliability and efficiency, also it gives effective data management and fully integrated information systems. But the drawback is that it cannot provide real time monitoring of water parameters.

Qiao Tie-zhu, Song Le, "The Design of Multi-ParameterOnline Monitoring System of Water Quality Based onGPRS,"[5] designed Online Monitoring System of Water Quality Based on GPRS. The system is used to process the sample and send the relevant data to the monitoring center via the GPRS data transmission. The aim of developing this system is the remote monitoring of water quality parameter and makes it real time and faster than previous system used for water quality monitoring, also to control water quality.

Dong He, Li-Xin Zhang, "The Water Quality MonitoringSystem Based on WSN,"[6] developed The Water Quality Monitoring System Based on WSN. This system based on wireless sensor network that consists of Wireless Water Quality Monitoring Network and Remote Data Center. The wireless sensor network is built on Zigbee network protocol. WSN sample the water quality, and sends the data to the Internet with the help of the GPRS DTU, having built-in TCP/IPprotocol used for data transmission. With the help of internet data is collected at a remote data center and analyzed and used for further processing. This system can be a long-term, stable and real-time regional water quality monitor. This system is low cost for small area, but for large area it will become costly.

NazleeniSamihaHaron, MohdKhuzaimi B Mahamad,Izzatdin Abdul Aziz, MazlinaMehat, "Remote Water Quality Monitoring System using Wireless Sensors,"[7] designed Remote Water Quality Monitoring System using Wireless

Sensors. In proposing system the wireless water quality sensors send data digitally to the data acquisition kit which collects the data transmitted from all sensors. The received digital data is processed by the data acquisition kit and processed data send to the database at which the processed data is compared with the tolerance value of that data. If the water quality parameters cross their threshold value, then the alert message will send using the GSM module, otherwise data keep continuously comparing with its tolerance value. This process is mainly developed for monitoring the water of ponds or lake.

KulkarniAmruta M., TurkaneSatish M., "Solar PoweredWater Quality monitoring system using wireless SensorNetwork,"[8] developed Solar Powered Water Quality Monitoring system using wireless Sensor Network. In this system the WSN technology powered using solar panel. The system consists node and base station in which the node collects that receive from the different wireless sensor. The node is connected to the base station through the Zigbee technology that powered by the solar panel. This system is low cost but if the solar panel cannot be charged because of the some environment effect then the system will stop working. From, all above mention methodology we come to know that every different system consist some limitation though it cannot meet the aim of real-time, low-cost continuous monitoring of water quality parameters. So, to overcome all this limitation, that leads us to be developed and design the new methodology that wills low-cost, real-time and user friendly.

Prof. Sachin S. patil, Prof. S. J. Patil, Prof. M. M. Raste "AIR POLUTANT MONITRING USING SENSOR NETWORKS"[9]: In this paper author describes the rapid development of the economy, more and more serious problems of environment arise. Water pollution is one of these problems. Routinely monitored parameters of water quality are temperature, pH, turbidity, conductivity, dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), ammonia nitrogen, nitrate, nitrite, phosphate, various metal ions and so on. The most common method to detect these parameters is to collect samples manually and then send them to laboratory for detecting and analyzing. This method wastes too much man power and material resource, and has the limitations of the samples collecting, long-time analyzing, the aging of experiment equipment and other issues. Sensor is an ideal detecting device to solve these problems. It can convert no power information into electrical signals. It can easily transfer process, transform and control signals, and has many special advantages such as good selectivity, high sensitivity, fast response speed and so on. According to these characteristics and advantages of sensors, Monitoring of Turbidity, PH & Temperature of Water is designed and developed. The measured values from the sensors can be processed by the core controller. Finally, the sensor data can be viewed on internet using cloud computing

Nikhil Kedia entitled "Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project."[10]This paper highlights thentire water quality monitoring methods, sensors, embedded design, and information dissipation procedure, role of government, network operator and villagers in ensuring proper information dissipation. It also explores the Sensor Cloud domain. While automatically improving the water quality is not feasible at this point, efficient use of technology and economic practices can help improve water quality and awareness among people.

Jayti Bhatia, jigneshpatoliya, "Real time water quality monitoring system"[11]This paper describes to ensurethe safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this paper, we present the design of IOT based water quality monitoring system that monitor the quality of water in real time. This system consists some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and these processed values are transmitted remotely to the core controller that is raspberry pi using Zigbee protocol. Finally, sensors data can view on internet browser application using cloud computing. Keywords— Water Quality Monitoring, IOT, Zigbee, Cloud Computing.

CHAPTER 3

SYSTEM DESCRIPTION

3.1 BLOCK DIAGRAM

The Block diagram of Real Time Water Quality Monitoring System Using IOT is as follows:

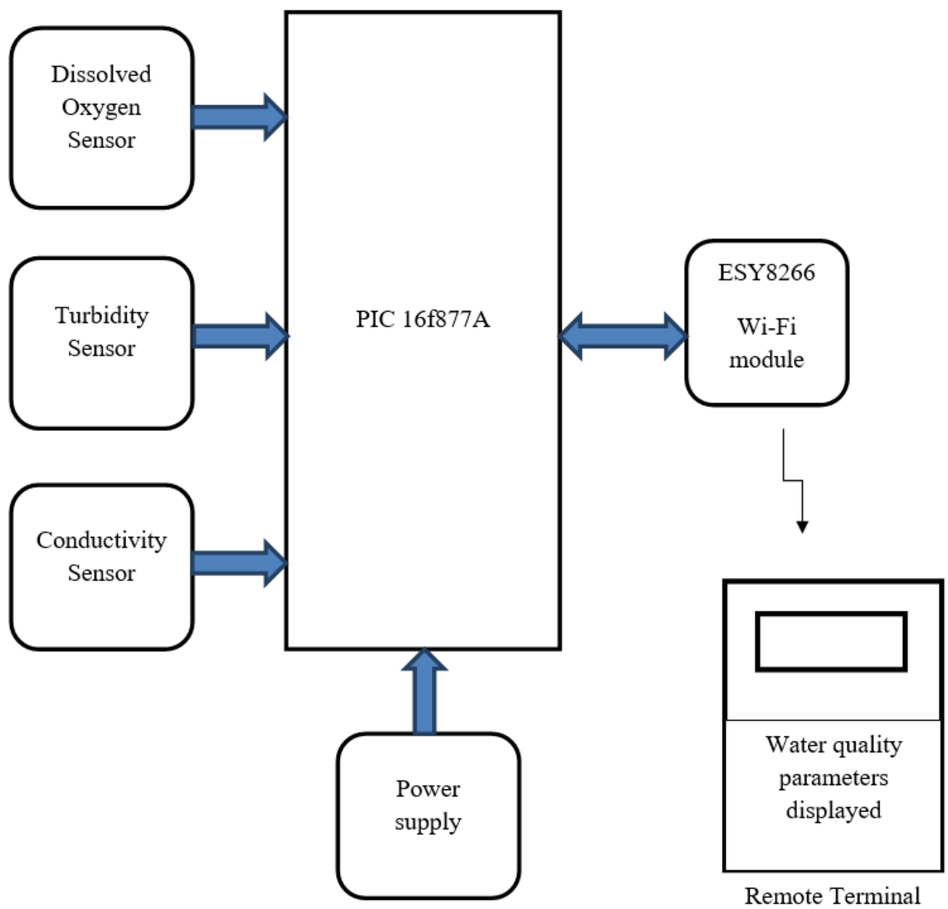

Fig. 3.1 Block diagramof Real Time Water Quality Monitoring System Using IoT

3.2 METHODOLOGIES

This section explains the complete block diagram of the proposed system. Also, it presents the detail explanation of each and every block. The overall block diagram of the proposed system is as shown in fig. 3.1. This proposed block diagram consist number of devices having respective sensors and the collected data from all devices are gathered atthe PIC controller via Wi-Fi module. The device consists several sensors for measuring water quality parameter such as turbidity, conductivity and dissolved oxygen.

The different water quality parameters will be measured by the sensors. The sensor will be interfaced to PIC controller similarly controller will be connected to the Wi-Fi module. In this way the water quality measured and monitored in real time. Also, if any of the measured water quality parameters exceeds the reference value stated for maintaining the quality of water, it will be displayed.

3.3 SYSTEM SPECIFICATIONS

The hardware required as follow:

- PIC 16f877a Microcontroller
- ESP 8266 Wi-Fi module
- Dissolved oxygen
- Turbidity
- Conductivity

3.3.1 PIC 16f877a Microcontroller

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 uses 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 applications in digital electronics circuits.

Fig.3.2 PIC 16f877A

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. It’s flexible and can be used in areas where microcontrollers have never been used before as in coprocessor applications and timer functions etc.

3.3.1.1. PIN CONFIGURATION AND DESCRIPTION of PIC16F877A

There are 40 pins of this microcontroller IC. It consists of two 8 bits and one 16-bit timer. Capture and compare modules, serial ports, parallel ports and five input/output ports are also present in it.

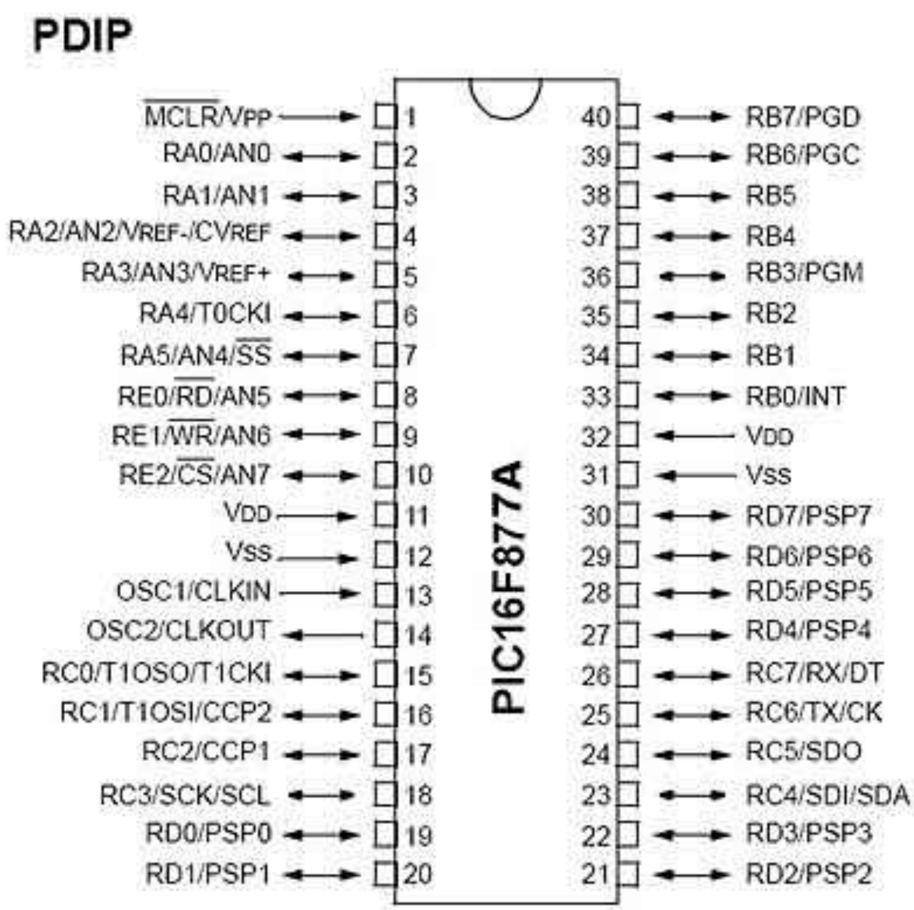

Fig.3.3 Pin Diagram of PIC 16f877A

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.

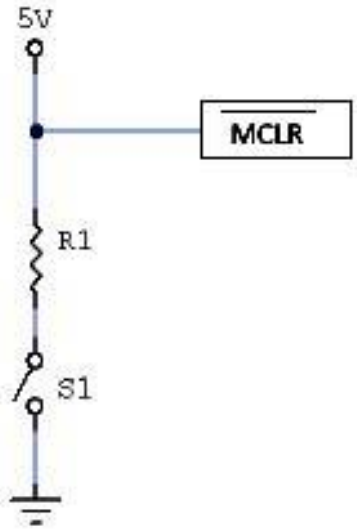

Fig.3.4 MCLR Connection

A push button and a resistor is connected to the pin. The pin is already being supplied by constant 5V. When we want to reset the IC we just have to push the button which will bring the MCLR pin to 0 potential thereby resetting the controller.

PIN 2: RA0/AN0

PORTA 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

To timer0 this pin can act as the clock input pin, the type of output is open drain.

PIN 7: RA5/SS/AN4

This 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

PORTE 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. ¼ of the frequency of OSC1 is outputted by OSC2 in case of RC mode. This indicates the instruction cycle rate.

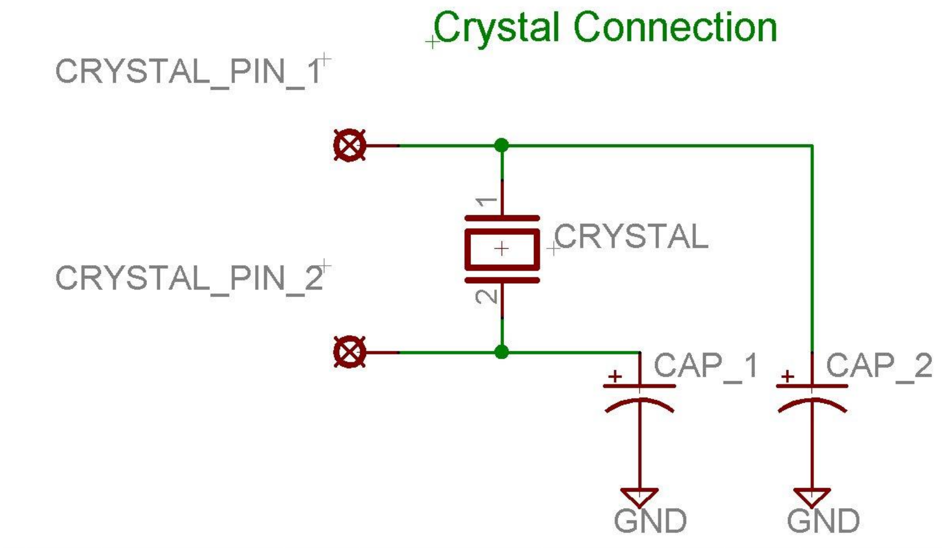

Fig.3.4. crystal connection

PIN 15: RC0/T1OCO/T1CKI

PORTC consists of 8 pins. It is also a bidirectional input output port. Of 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 pin. Or in 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 PORTD 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 PORTB. Out of which RB0 can be used as the external interrupt pin and RB6 and RB7 can be used as in-circuit debugger pins.

3.3.1.2 Regulated Power Supply

The unregulated power supply ranging from 9volt to 12volt DC. To make a 5volt power supply, KA8705 voltage regulator IC has been used. The KA8705 is simple to use. Simply connect the positive lead form unregulated DC power supply (anything from 9VDC to 24VDC) to the input pin, connect the negative lead to the common pin.

3.3.1.3Comparison of PIC Microcontroller

Table1:Comparison of PIC Microcontroller

Key Features PICmicro™ Mid-Range Reference Manual (DS33023)	PIC16F873	PIC16F874	PIC16F876	PIC16F877
Operating Frequency	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz	DC - 20 MHz
RESETS (and Delays)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)
FLASH Program Memory (14-bit words)	4K	4K	8K	8K
Data Memory (bytes)	192	192	368	368
EEPROM Data Memory	128	128	256	256
Interrupts	13	14	13	14
I/O Ports	Ports A,B,C	Ports A,B,C,D,E	Ports A,B,C	Ports A,B,C,D,E
Timers	3	3	3	3
Capture/Compare/PWM Modules	2	2	2	2
Serial Communications	MSSP, USART	MSSP, USART	MSSP, USART	MSSP, USART
Parallel Communications	—	PSP	—	PSP
10-bit Analog-to-Digital Module	5 input channels	8 input channels	5 input channels	8 input channels
Instruction Set	35 instructions	35 instructions	35 instructions	35 instructions

3.2. ESP8266 Wi-Fi MODULE

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements. Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface.

Fig.3.5.Wi-Fi module

ESP8266 FEATURES

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Supports antenna diversity
- Power down leakage current of < 10uA
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4μs guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

3.3.2 **WQ-COND CONDUCTIVITY SENSORS**

The process by which the capability of water is checked by conducting electricity which is defined as the term Conductivity. Pure water always having poor conductivity.

The Global Water WQ-COND Conductivity Sensors are suitable for measuring conductivity in a wide variety of applications including laboratories, streams, rivers, and groundwater. The conductivity sensor's small size and rugged housing make it useful for hand held measurements or permanent installation.

The conductivity sensors use a 4-electrode measuring technique that provides accurate readings over a wide range of conductivities and temperatures. Because the conductivity of ionic solutions increases with increasing temperature, a temperature sensor is also incorporated and is used to provide automatic temperature compensation of 2%/°C normalized to 25°C. An in-line interface module converts the digital conductivity sensor and temperature data into two separate 4-20mA signals for monitoring with data loggers and PLC devices.

Fig.3.6. Conductivity sensor

The standard conductivity sensors come with three feet (one meter) of cable between the conductivity sensor and interface module, and 25 feet of marine grade cable for connecting to recording devices. Additional cable can extend the length of the conductivity sensor up to 500 feet. Available conductivity ranges are 0-200µS/cm, 200-2000µS/cm, 2-20mS/cm, 20-200mS/cm and 200-2000mS/cm. The conductivity sensor's temperature output has a measurement range of -5°C to +70°C.

Global Water's GL500-7-2 Conductivity Sensor Recorder adds recording capabilities to the conductivity sensor. The GL500-7-2 Conductivity Sensor Recorder connects to the conductivity sensor's 4-20mA outputs to record data. In addition, Global Water offers the PC320 Conductivity Controller to use the conductivity sensor's output to control pumps or alarms.

FEATURES

- 0.5% conductivity reading accuracy
- Dual 4-20 mA outputs, temperature and conductivity
- Measurement span from 0 to 2 siemens/cm
- Sensor armor available for harsh environments

- Measure conductivity up to 82 feet depth
- Fully encapsulated electronics

3.3.4. TURBIDITY SENSOR SKU: SEN0189

Turbidity is a measure of the cloudiness of water. Cloudiness is caused by suspended solids (mainly soil particles) and plankton (microscopic plants and animals) that are suspended in the water column.

The gravity arduino turbidity sensor detects water quality by measuring the levels of turbidity. It uses light to detect suspended particles in water by measuring the light transmittance and scattering rate, which changes with the amount of total suspended solids (TSS) in water. As the TTS increases, the liquid turbidity level increases. Turbidity sensors are used to measure water quality in rivers and streams, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transporter search and laboratory measurements. This liquidsensor provides analog and digital signal output modes. The threshold is adjustable when in digital signal mode. You can select the mode according to your MCU.

Fig. 3.7. Turbidity Sensor

Specifications

- Operating Voltage: 5V DC
- Operating Current: 40mA (MAX)
- Response Time : <500ms
- Insulation Resistance: 100M (Min)
- Output Method:
  - Analog output: 0-4.5V
  - Digital Output: High/Low level signal (you can adjust the threshold value by adjusting the potentiometer)
- Operating Temperature: 5℃~90℃
- Storage Temperature: -10℃~90℃
- Weight: 30g
- Adapter Dimensions: 38mm*28mm*10mm/1.5inches *1.1inches*0.4inches

3.4. INTERNET OF THINGS (IOT)

In the past decade, all human life changed because of the internet. The internet of things has been heralded as one of the major development to be realized throughout the internet portfolio of technologies. The Internet of Things (IOT) is concerned with interconnecting communicating objects that are installed at different locations that are possibly distant from each other. Internet of Things represents a concept in which, network devices have ability to collect and sense data from the world and then share that data across the internet where that data can be utilized and processed for various purposes.

The internet of things describes a vision where objects become part of internet: where every object is uniquely identified and access to the network. IoT communication is quite different from the traditional human to human communication, bringing large challenge to existing telecommunication and infrastructure. Furthermore, IOT provides immediate information regarding access to physical objects with high efficiency. The concept of Internet of Things is very much helpful to achieve real time monitoring of sensor data. Internet of Things (IOT) is a kind of network technology, which is based on information sensing equipment's such as RFID, infrared sensors, GPS, laser scanners, gas sensors and so on, can make anything join the Internet to exchange information, according to the protocol, which gives intelligent identification, location and tracking, monitoring and management. The application area of IOT includes building and home automation, smart city project, smart manufacturing of various products, wearable's, health care systems and devices, automotive etc.

IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, and robotics. IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services; and the social, economic, and political impact of those changes.

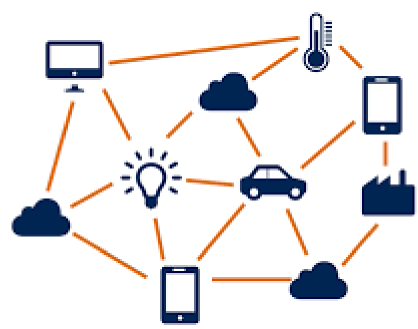

Fig. 3.8 IOT Network

3.4.1 IoT Features

The most important features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. A brief review of these features is given below:

- AI – IoT essentially makes virtually anything "smart", meaning it enhances every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. This can mean something as simple as enhancing your refrigerator and cabinets to detect when milk and your favorite cereal run low, and to then place an order with your preferred grocer.

- Connectivity – New enabling technologies for networking, and specifically IoT networking, mean networks are no longer exclusively tied to major providers. Networks can exist on a much smaller and cheaper scale while still being practical. IoT creates these small networks between its system devices.
- Sensors – IoT loses its distinction without sensors. They act as defining instruments which transform IoT from a standard passive network of devices into an active system capable of real-world integration.
- Active Engagement – Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for active content, product, or service engagement.
- Small Devices – Devices, as predicted, have become smaller, cheaper, and more powerful over time. IoT exploits purpose-built small devices to deliver its precision, scalability, and versatility.

3.4.2 Advantages

Some advantages of IoT are as follows:

- **Data**: The more the information, the easier it is to make the right decision. Knowing what to get from the grocery while you are out, without having to check on your own, not only saves time but is convenient as well.
- **Tracking**: The computers keep a track both on the quality and the viability of things at home. Knowing the expiration date of products before one consumes them improves safety and quality of life. Also, you will never run out of anything when you need it at the last moment.
- **Time**: The amount of time saved in monitoring and the number of trips done otherwise would be tremendous.
- **Money**: The financial aspect is the best advantage. This technology could replace humans who are in charge of monitoring and maintaining supplies.

3.4.3 Disadvantages

Some disadvantages of IoT are as follows:

- **Compatibility**: As of now, there is no standard for tagging and monitoring with sensors. A uniform concept like the USB or Bluetooth is required which should not be that difficult to do.
- **Complexity**: There are several opportunities for failure with complex systems. For example, both you and your spouse may receive messages that the milk is over and both of you may end up buying the same. That leaves you with double the quantity required. Or there is a software bug causing the printer to order ink multiple times when it requires a single cartridge.
- **Privacy/Security**: Privacy is a big issue with IoT. All the data must be encrypted so that data about your financial status or how much milk you consume isn't common knowledge at the work place or with your friends.
- **Safety**: There is a chance that the software can be hacked and your personal information misused. The possibilities are endless. Your prescription being changed or your account details being hacked could put you at risk. Hence, all the safety risks become the consumer's responsibility.

CHAPTER 4

ADVANTAGES AND DISADVANTAGES

4.1. ADVANTAGES

- This project is more suitable to monitor water quality parameters in real time.
- To monitor data from various locations IOT environment is provided.
- No need to visit the location to monitor the water quality parameters.
- Use of PIC microcontroller reduces the price of system by great extent.
- Due to real time monitoring the water quality parameters are available whenever required which can indicate any water contamination occurred.

4.2. DISADVATAGES

- Accuracy of the measured value depends on the sensor used.
- Required internet connection for real time water quality parameters monitoring.

CHAPTER 5

APPLICATION

- Domestic water is intended for human consumption for drinking and cooking purposes. The Bureau of Indian Standards (Central Ground Water Board, 2017) provides details about acceptable limits of substances such as Aluminum, Ammonia, Iron, Zinc etc. Traditional water quality measurement involves manual collection of water at various locations, storing the samples in centralized location and subjecting the samples to laboratory analytical testing Such approaches are not considered efficient due to the unavailability of real time water quality information, delayed detection of contaminants and not cost effective solution. Hence, the need for continuous online water quality monitoring.
- Pollution levels in sea: measuring levels of temperature, salinity, oxygen and nitrates give feedback for quality-sensing system in seawater.
- Chemical leakage detection in revisers: Extreme pH or low DO values -signal chemical spills due to sewage treatment plant or supply pipe problem.
- The water quality monitoring is important for several applications such as environment monitoring of pond and ecosystem, drinking water distribution and measurement, contamination detection in drinking water.

CHAPTER 6

CONCLUSION

Water quality monitoring has become necessary work in environmental protection. Automating monitoring and telemetry is a trend for improving the ability of water quality monitoring system.

With the help of sensors we can check the water quality by use of Wi-Fi module. Since the system is automatic therefore it is low in cost and does not require man power so time and powers both are save. It has widespread application and extension value.

CHAPTER 7

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