Smart Water Management using Iot Environment

Abstract--- **This project helps to regulate the proper maintenance of water tank information to monitoring section with proper updation of records. problem affects various processes in water management, such as water consumption, distribution, Water dust formed in the water tank. These problem can overcome by implementing proper monitoring system and information update system. Set of sensor like Turbidity, Salt sensor, pH sensor and Water flow sensors were used. This sensor informs about the water level tank and communicate to the monitor section. To maintain the tank without bacteria and microbes the Chlorine powder is sprayed if there is any changes in the ph value is found. If the water level reaches minimum position the motor automatically starts and when it reaches the maximum the motor stops automatically. A wireless sensor network is formed by connecting two and more water tanks using RF radio channel transceiver with monitoring section.**

Keywords: Internet of Things(IoT), Water parameters, Wireless Sensor Network(WSN), RF Wireless transceiver.

I.INTRODUCTION

In the 21st century, there were lots of inventions, but at the same time were pollutions, global warming and so on are being formed, because of this there is no safe drinking water for the world's pollution. Nowadays, water quality monitoring in real time faces challenges because of global warming limited water resources, growing population, etc. Hence there is need of developing better methodologies to monitor the water quality parameters in real time. The monitoring of water quality is extremely important for maintaining the safety of water resources used for various purposes such as drinking, recreation or food processing. Water quality is determined by interdependent chemical, physical, and microbial factors, including but not limited to pH, turbidity, conductivity, and water level in the tank. Many conventional water quality monitoring technologies lack integration, are labour-intensive, time-consuming, and expensive. Typically, in many systems, only one parameter such as free chlorine or pH is measured at a time. The water quality parameters pH measures the concentration. It shows the water is acidic or alkaline. Pure water has 7pH value, less than 7pH has acidic, more than 7pH has alkaline. The range of pH is 0-14 pH. For drinking purpose it should be 6.5-8.5pH. Turbidity measures the large number of suspended particles in water that is invisible. Lower the turbidity then the water is clean. Temperature sensor measures how the water is, hot or cold. Flow value is used regulated the flow of water through electromagnetic relay water value. The traditional methods of water quality monitor involves the manual collection of water samples from water tank. Monitoring the water quality using the developed integrated sensing system has two sets of important advantages over using discrete sensors and conventional analytical methods.

IoT is progressing with millions of things connecting each day to generate large amount of information resulting in useful future actions.To ensure the 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 project, we will implement the design of IOT for monitoring system that monitors the quality of water in real time. This system consists some sensors which measure the water quality parameter.The real-time monitoring of water resources information will benefit the water resources management department and the public. The primary concept of real-time IOT based water resources information system is to provide comprehensive and accurate information. The system is developed through defining some explicit water resource parameters then, Water level are defined for

water measure & management, followed by a sensor network for water resources information monitoring is constructed based on IOT.

II. BASIC ELEMENTS

A. Micro Controller- TheAtmega328isa one of thevery popular microcontroller chip produced by Atmel It is an 8 - bit microcontroller that has32Kof flash memory, 1K of EEPROM, and2K ofSRAM.The Atmega328 is one of the microcontroller chips that are used with the popular Arduino boards.This microcontroller hasanalogpin and digital pin for easy interface of the =MicrocontrollerOperating Voltage: – 1.8 - 5.5V23 Programmable I/OLinesTwo 8-bit Timer/CountersReal Time Counter with Separate OscillatorSix PWM Channels6-channel 10-bit ADC .

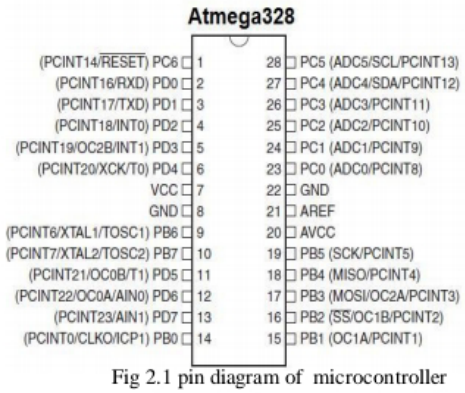


Fig 2.1 pin diagram of microcontroller

B..IOT Module

Wi-Fi Direct (P2P), soft-APIntegrated TCP/IP protocol stack+19.5dBm output power in802.11b modeSupports antennadiversityPower down leakage current of <10Ua Integrated low power 32-bit CPU could be used as application processorSDIO 2.0, SPI, UARTWake up and transmit packets in <
2msStandby power consumption Operating Voltage :

3.3V

Fig 2.2 esp 8266

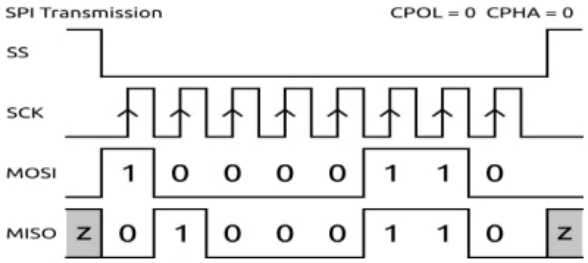
Theesp8266 module it is a 8 pin .vccia power supply.and it is operated by the voltage is 3.3v .This is exceed and it isburn the esp module.GND is connected to the ground terminal.Rx pin is the receiver pin UART serial communication The Tx pin is a transmitter.GPIO general purpose input and output.Reset pin reset the module apply in 3.3v. the CH-PD pin configure channel.

C..nRf transreceiver

The nrfwireless transreceiver is 8 pin of the operation. GND pin it isalso used to for the ground terminal.Vccis a power supply operated bythe voltagerange is 1.9v to the 3.6v and it is mostly apply the 3v . The CE pin is a select the mode of operation either is operated by transmit data or receive a data.CSN it is used to for the enable the SPI chip.SPI provise is high the clock is enableand low the clock is disable.MOSI transmit a data from user module to the external circuit.MISO receive a data from the external circuit or modulethen finally IRQ ias interrupt request pin it isdoes not need to connect

Fig 2.3 nrf 2401L

Connection in Wireless Communication. This communication is called as Serial Peripheralinterface (SPI) . It has following pin name Serial Peripheral Interface, or SPI is a very common communication protocol used for two-way communication between two devices. A standard SPI bus consists of 4 signals, Master Out Slave In (MOSI) Master In Slave Out (MISO), the clock (SCK), and Slave Select (SS)An SPI bus has one master and one or more slavesThe master can talk to any slave on the bus, but each slave can only talk to the master.Each slave on the bus must haveit's own unique slave select signal.The master uses the slave select signals to *select* which h *slave* it will be talking to.



The SPI bus consists of 4 signals or pins. They are

Fig 2.4 SPI method

- Master – Out / Slave – In (MOSI)
- Master – In / Slave – Out (MISO)
- Serial Clock (SCLK) and
- Chip Select (CS) or Slave Select (SS)

MISO pins on both the master and slave are ties together. Even though the Signal in MISO is produced by the Slave, the line is controlled by the Master . The Master generates a clock signal at SCLK and is supplied to the clock input of the slave. Chip Select (CS) or Slave Select (SS) is used to select a particular slave by the master.

Master – Out / Slave – In or MOSI, as the name suggests, is the data generated by the Master and received by the Slave. Hence, MOSI pins on both the masterand slave are connected together. Master – In / Slave – Out or MISO is the data generated by Slave and must be transmitted to Master.

Configuration of nRF24L01

RF24 radio (CE, CS) --- mention the pin connection
Mention the pipe address
Uint64_t pipe = 0xE8E8F0F0E1LL
Radio.begin (); Start the process
Radio.openWritingPipe (pipe)
Radio.write(msg,1); Radio.startlistening();
Radio.available() – to check any incoming message

III.SELECTED SENSORS *A.*

Salt Sensor

It is used to monitoring the salt content of the sewage water and communicate with microcontroller for posting this information to internet. It has consists of two rods one is reference rod and measuring rod. The voltage is given to the reference rod and the conducting current passes to measuring rod. The voltage present in the measuring rod is proportional to the salt content of the water.

B.pH Sensor

pH sensor used to determine the pH value content in the water. The pH value range from the acidity – Neutral – Alkaline. It has two rod to measure the value of the pH value in the water. The pH meter is used for the quality check if water is safe for drinking. A balanced pH level is very important for human health; it should be approximately equal to 7. It gives Full range pH reading from 1 to 5 voltage scale range and gives a Single reading.

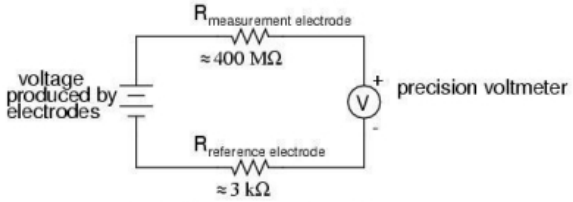


Fig:3.1 Circuit design for pH sensor

Reference Value of pH Sensor in terms of Voltage for Water

pH Sensor Value	Output Voltage	Level
3	0	Acidic pH
4	1	
5	1.5	
6	2	
7	2.5	Neutral
8	3.5	Alkaline pH
9	4	
10	5	

C. Turbidity sensor

The turbidity sensor SKU: SEN0189 is used to detect water quality by measuring level of turbidity. The turbidity sensor enables the detection of suspended particles in water by measuring the light transmittance and analogue and digital signal output modes, either of the mode can be selected according

to the microcontroller unit (MCU). The threshold is adjustable by adjusting the potentiometer in digital signal mode. The operating voltage of the turbidity sensor is 5V DC and the operating current is 40mA (max) respectively.

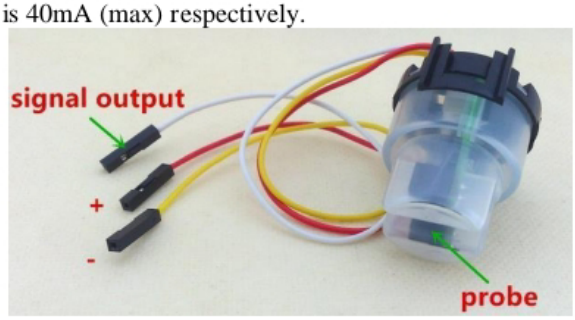


Fig:3.2 Structure of turbidity sensor

Specification

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)

D.Ultrasonic Sensor

This is used to measure the level of the water in the Tank in term of distance from top to surface of water. The distance value shown in Centimetre in display unit. From this sensor we find the level of the water level. This ultrasonic sensor is operated by emitting high-frequency sonic wave at regular time interval starting from the front of the transducer. The sonic waves are reflected by an object and received back in the transducer. The time interval between emitting and receiving sound waves is proportional to the distance between the transducer and the object can be calculated. As the ultrasonic sensor is using sound wave instead of light wave, it is more suitable for sensing uneven surface such as water surface. According to its datasheet, the ultrasonic sensor detects objects from 0-inches to 254-inches (6.45-meters) and provides sonar range information from 6-inches out to 254-inches with 1-inch resolution.

Fig:3.3 Circuit diagram for ultrasonic sensor

IV..CIRCUIT DIAGRAM

A.Circuit Diagram For Monitoring System

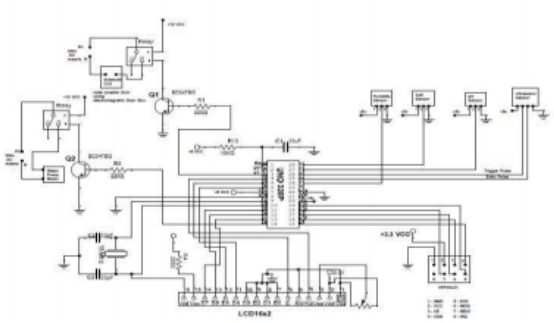


Fig:4.1 Circuit diagram for monitoring system

This circuit consists of ATMEGA 328 p which is used to collect the data from the sensor and post to main unit through wireless transceiver. It has 14 digital I/O pins, of which 6 can be used as PWM outputs and 6 analog input pins. These I/O pins account for 20 of the pins. 2 of the pins are for the crystal oscillator. This is to provide a clock pulse for the Atmega chip. A clock pulse is needed for synchronization so that communication can occur in synchrony between the Atmega chip and a device that it is connected to.

The chip needs power so 2 of the pins, Vcc and GND, provide it power so that it can operate. The Atmega328 is a low-power chip, so it only needs between 1.8-5.5V of power to operate. The Atmega328 chip has an analog-to-digital converter (ADC) inside of it. This must be or else the Atmega328 wouldn't be capable of interpreting analog signals. Because there is an ADC, the chip can interpret analog input, which is why the chip has 6

pins for analog input. The ADC has 3 pins set aside for it to function- AVCC, AREF, and GND. AVCC is the power supply, positive voltage, that for the ADC. The ADC needs its own power supply in order to work. GND is the power supply ground. AREF is the reference voltage that the ADC uses to convert an analog signal to its corresponding digital value. Analog voltages higher than the reference voltage will be assigned to a digital value of 1, while analog voltages below the reference voltage will be assigned the digital value of 0. Since the ADC for the Atmega328 is a 10-bit ADC, meaning it produces a 10-bit digital value, it converts an analog signal to its digital value, with the AREF value being a reference for which digital values are high or low. Thus, a portrait of an analog signal is shown by this digital value; thus, it is its digital correspondent value.

The processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- Program memory and the data memory. The code is stored in the flash program memory, whereas the data is stored in the data memory. The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader), 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz.

The wireless communication of nRF2401 connected to the Digital pins of D9 to D13 according to the datasheet of microcontroller. LCD display of 16x2 is connected to digital pins of D2 to D7 with control lines of EN,RS,D4,D5,D6 and D7. The sensor are connected to the analog port from A5 to A3. The sensor are pH sensor , Turbidity sensor , Salt sensor and temperature sensor to respected port pins.

The analog value of the sensor is used to convert by using following formula

Vout = (Analog voltage / 1024)*5

Where 1024 is resolution of the sensor and 5 is the reference voltage .

The various data collected from the sensor is sent to the main section through nRF24L01 transceiver by using address of the pipe lines with array of data's. The connection of the Transceiver with various handshake process and acknowledge process help to connect the transceiver board.

The another sensor is pH electrode. it is similar to the soil moisture value . it also consists of two electrode reference and measuring electrode. When electrode drip in dry soil , the conduction depends on salt level of the soil .pH value of a soil is taken and programmed in the microcontroller.

B.Circuit Diagram For Main Unit

The circuit diagram consist of microcontroller, IoT module, wireless Trance receiver, buzzer. This circuit is used to post the data to the internet by collecting the data from industrial sewage waste monitoring system. The wireless Trance receiver module is connected to the pin number of microcontroller D8 to D13

IOT module is connected to the microcontroller in
pin number of d2 d3. The module split the data from microcontroller to internet through Wi-Fi router. IoT module device consist of TCP/ IP self-supported programming module can include header and trailer frame format. From microcontroller data send to module is pre-processed in HTML language. From wireless trans receiver module the data are stored in array format which contains various parameter of air bye various gas sensor. Received data is shown in LCD display and it is connected in microcontroller of pin number ofd2tod8.

The wireless trans receiver consist of pipe address which will be matched with transmission section with the length of 16 bits this pipe address will be communicated both wireless module when data received by receiver it send data store microcontroller through serial peripheral interface Technology it is
called as spi. This SPI contains serial communication which has 2 lines MISO and MOSI with serial clock

This transceiver module is send to data to microcontroller through serial format with address. The program used in the microcontroller is filter the address and data and send the corresponding module of the program. This data is separate and display in the LCD display and send to the IOT module. The user has to the type IP address in the browser which will connect the browser to the IOT module through Router . The Router give the data to the user web browser based on the IP address type in the browser. The microcontroller preformatted the data in HTML coding and send to the Internet . it is easy to display in the web browser.

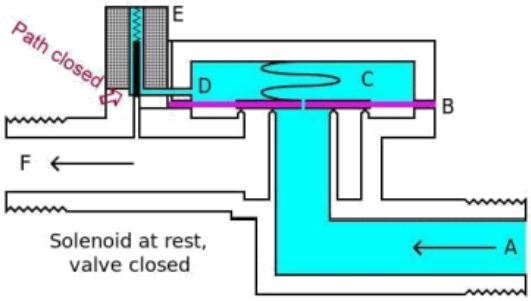


Fig 5.2 Value at OFF state

B.Water pump motor

This is a mini submersible type water pump that works on 12V DC. It is extremely simple and easy to use. Just immerse the pump in water, connect a suitable pipe and power the motor to start pumping water. Great for building science projects, fire-extinguishers, fire fighting robots, fountains,

waterfalls, plant watering systems etc. This motor is small, compact and light. It is manufactured to be used in automobiles for spraying wiper water, hence it is quite durable. It can be controlled from a micro controller/Arduino using our DC Motor Drivers or one of our Relay Boards

Fig 5.4 Water pump motor

VI . CONCLUSION

An internet-based approach to measuring water quality and delivery systems on a real-time basis. The results of the various parameters of water quality are verified that the system achieved the reliability and feasibility of using it for the actual monitoring purposes. The WSN network will be developed in the future comprising of more number of nodes to extend the coverage range. In our proposed system, water level can be monitored continuously from anywhere using web browser. Motor can be controlled automatically full smart automation is achieved. It is a robust system & small in size. This Project uses ultrasonic sensors which provide more accurate and calibrated information for water level in tank. An electromagnetic box is used to drop the chlorine power in the tank by automated system and show the various parameter of water in a web browser that can be viewed any whereby user.

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