IDEATION PHASE

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Assignment Date	20 September, 2022
Team ID	PNT2022TMID03762
Project Name	Real-Time River Water Quality Monitoring and Control System
Maximum Marks	4 marks

Ideation Phase:

The main goal is to develop a system for continuous monitoring of river water quality at remote locations using a wireless sensor network with low power consumption, low cost and high detection accuracy. pH, conductivity, turbidity level, etc. are the limits that are analyzed for water quality improvement. The following are the goals of realizing the idea

- To measure water parameters such as pH, dissolved oxygen, turbidity, conductivity, etc. using available sensors at a remote location.
- Compile the data from different sensor nodes and send it to the base station using wireless channel.
- Simulate and evaluate quality parameters for quality control.
- Regularly send an SMS to the authorized person when the detected water quality does not conform to preset standards so necessary measures may be taken.

Control surface

An Arduino mega is utilized as a core person. The Arduino victimized here is mega 2560 because multiple analog sign sensors probe requisite to be conterminous with the Arduino inhabit. It has a set of registers that use as a solon use RAM. Specific intend to know registers for on-chip component resources are also mapped into the assemblage grapheme. The addressability of store varies depending on instrumentation series and all PIC devices someone several banking mechanisms to utilize addressing to additional faculty. Subsequent series of devices have move instructions which can covert move had to be achieved via the register. Thus, the mechanism functions with the exploit of coding intrinsically in the Arduino UNO R3 skate.

pH sensor

The pH of thing is a useful constant to display because graduate and low pH levels can hump large effects on the author. The pH of a statement can grasps from 1 to 14. A pH sensor is an

instrumentation that measures the hydrogen-ion density in a bleach, indicating its tartness or alkalinity. It constitutes varies from 0 to 14 pH. Uttermost pH values also process the solubility of elements and compounds making them cyanogenetic. Mathematically pH is referred as, pH = -log [H+].

Turbidity sensor

Turbidity train sensor is victimized to measure the clarity of element or muddiness utter in the water. The muddiness of the open cut food is ordinarily between 255 NTU. Irrigate is visibly at levels above 80 NTU. The standards for intemperance liquid is 130 NTU to 250 NTU. The turbidity device consists of soft sender and acquirer, the transmitter needs to transmit unsubtle bright, it is said to be turbid. The consequence of turbidity is a reduction in water clarity, aesthetically unpleasant, decreases the rate of photosynthesis, increases water temperature.

Temperature sensor

Here DS18B20 is old as the temperature device. Usually, its present use to perceive the temperature of the life, if we site the device wrong the conductor electrode and placed into the H2O, it can discover the temperature of H2O also. The normal temperature of the people is (25 - 30)°C.

LCD display

LCD (Liquid Crystal Display) impede is a flat brace electronic exhibit power and finds in a countywide orbit of applications. A 16x2 LCD demo is the really fundamental power and is rattling commonly victimised in varied devices and circuits. These modules are desirable over heptad segments and otherwise multi-segment LEDs.

Wi-Fi module

Wi-Fi or Wi-Fi is a subject for wireless localized area scheme with devices. Devices that can use Wi-Fi study permit private computers, video-game consoles, smartphones, digital cameras, paper computers, digital frequency players and ultramodern printers. Wi-Fi matched devices can insert to the Cyberspace via a LAN web and wireless make a bushel. Much a reach quantity (or point) has a capableness of around 20 meters (66 feet) indoors and a greater compass outdoors. Wi-Fi subject may be utilized to render the Internet reach to devices that are within the capability of a wireless meshwork that is connected to the Internet.

Software design

The proposed water quality monitoring system based on WSN can be divided into three parts:

- IoT platform
- Neural network models in Big Data Analytics and water quality management
- Real-time monitoring of water quality by using IoT integrated Big Data Analytics

IoT Platform

The quality parameters are labeled datasets including desired outputs of specific combination of inputs. The neural network will produce output to classify water quality as dangerous, be careful, and good. The classification layer will run on top of Hadoop cluster. The advantages of using neural network-based analytics are like Artificial Neural Networks (ANNs) are good in learning and modeling non-linear relationships, and high volatile data. Though neural networks are prone to over fitting, the neural network model used in water quality monitoring system is not complex enough to cause over fitting problem. Also, there are many countermeasures to avoid over fitting. Also, computation overload is not going to delay the response of system as there are only a few water quality parameters.

Neural network models in Big Data Analytics and water quality management

The use of artificial neural networks for the prediction of water quality parameters has already been investigated long before [19]. Multi-layer neural network model is depicted below having five inputs In 1, In 2, In 3, In 4, In 5 in input layer, a hidden layer with four neurons and three neurons in output layer. There are two bias input neurons connected to hidden layer neurons and output layer neurons. The detailed scheme of Multilayer Perceptron Model designed in Neuroph Studio is shown in Figure 3. In the neural network model 5 inputs can be pH value, temperature, turbidity, ORP, and conductivity and 3 outputs will be dangerous, be careful, and good. Before training the neural network model few other parameters need to be set; as for example: Learning rate = 0.01, Learning algorithm = Back Propagation, Bias input = 1, Connection weights = randomly assigned, Activation function = sigmoid function. The output of sigmoid function neuron with inputs: Xj, weights: Wj and bias b is $F(X) = 1 / (1 + \exp(-\sum j\ wjxj - b))$

Real-time monitoring of water quality by using IoT integrated Big Data Analytics

IoT devices use various types of sensors to collect data about turbidity, ORP, temperature, pH, conductivity, etc. of river water continuously. Also, IoT devices have capability to stream the array of collected data wirelessly to the remote Data Aggregator Server in the cloud. Moreover, the volume of semi structured data increases with time in such a velocity that only the Big Data Analytics applications can efficiently store and analyze the data constantly