**Problem statement:**

Our government lacks in real-time water quality monitoring of Ganga river due to which not only human life but environment and aquatic life is affected.

Our proposed method for real-time water quality monitoring system is an interconnected system of sensor, raspberry pi, cloud storage and a web service (a website). In our system Raspberry pi act as main controller which is used to read data from sensor. It also act as a workstation for transmission of this data to cloud storage. Sending of alert email is done using PHP. For clear explanation of proposed system e have divided this in following categories:-

1. **Sensor module** :-The DS18B20 is a temperature sensor is used which has a built in analog-to-digital convertor (ADC). It has 12bit ADC. It can be connected to a raspberry pi’s GPIO pins. It is a 3 pin sensor. Pin 3 acts as power line ( vdd pin 3), pin1 as ground and pin 2 is actual data-output (DQ pin 2) pin. The DQ requires a 4K7 pull-up resistor. It has a temperature range from -55degree Celsius to +125degree Celsius .PHP: hypertext preprocessor language is used to read data output of DS18B20.
2. **Transmission module**:- This part consists of data transmission to the server and also to show this data on a web service. Amazon web services AWS EC2, AWS IOT and mongo dB is used for this purpose. To send data from raspberry pi to AWS server backend language Node JS is used. Saying more precisely Socket.io library of Node JS is used. This sensor data is stored on cloud which is mongo dB based backend server known as mongolab (now known as mlab). Mlab is well managed cloud based database service that hosts Mongo DB databases. To retrieve this data from cloud client side socket.io library of nodejs is used. For front end of web service HTML, CSS, JavaScript and for map, google map Application program interface (API) is used. Google map marker are used to show the location of installed sensor module. When the condition at particular position reaches to an alarming level, image of marker is changed from ranger\_station.png (green color) to caution.png (red color).
3. **Alarm module**:- When the water condition at particular sensor module reaches to an alarming level, an email is sent to the civic authorities. To send email PHP: hypertext preprocessor (PHP) language is used. This email is sent to both local as well as central authorities so that central authorities can direct local authorities to carry out necessary action. The email is sent automatic using functions of JavaScript. Also when any of the node is not working properly (when raspberry pi is switched off) an e-mail is sent to the local authorities.
4. **Implementation strategy** :- Our monitoring scenario is divided in four categories viz. area near industries/factories, area near agricultural land and fields, area near canals and area near residential area. Each monitoring area consists of sensor module nodes which will send us data. The number of nodes in particular area can vary depending upon type and amount of pollutants. For example the nodes near residential area will consists of different type of sensor than area near farmland and factories. area near farms have cadmium , arsenic , lead and mercury as prime pollutants therefore these ion sensors will be present in that particular node rather than pH or temperature sensor . Similarly chemical sensor must be present in nodes present near industries as heavy metals like nickel, zinc and molybdenum are present near industries. The water quality changes at different depths. So at monitoring positions nodes are deployed at different depths so than complete and real status can be accessed at every depth of river. Since these sensors nodes have their core controllers in open environment solar panels can be used as power source. Also provision are made to switch power to normal battery when power from solar cell cannot be used or in case of failure of solar cell.

**FUTURE SCOPE**

The future scope of this proposed system is wide. This is an ever evolving thing which can play a major role in smart India. There are lots of places where this can be used. Few of them along with other scope is mentioned below:-

1. For the first phase only temperature sensor is used. In future we can replace the sensing module with desired sensor, also we can add other sensor along with previous one keeping the same architecture.
2. This proposed system architecture can be used to monitor water quality in dams, reservoirs and can also be implemented in rural areas, which is generally ignored area.
3. We can also use this for personal use like in house water quality monitoring , checking whether tank water is clean or not, whether it requires cleaning or not ,etc.
4. It can be used in overhead water tanks.
5. The data collected from rivers, dams, reservoirs can be used for analysis. It can be published on mygov.in.
6. Change in water quality over a span of time of any particular area can be analyzed by the data collected and proper measures can be taken to save water resource.
7. Depending upon the quality of water in an area, setting up of industries can be restricted.