AUTOMATED WATER QUALITY MONITORING SYSTEM

User manual

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1.Introduction

Water quality plays an important role in water contamination surveillance and guides the water resource protection for safe and clean water. A flexible automated real-time water quality monitoring and alarm system based on the wireless sensor network for a water treatment plant is implemented.

This system is built in accordance with node MCU communication protocol, which consists of the sensor nodes, route nodes and coordinator node. The sensor nodes based on cheap and efficient sensors (pH sensor and turbidity senor) are collected.Then those data are transmit to the server with encryption process with the help of wifi module and display the data on the web site. The time synchronous algorithm is adopted to wake up all the nodes in the network to improve the stability and reliability of the communication. The long-time measurement results verify the real time and accuracy in data acquisition and stability and reliability in communication. The system meets the requirements of water quality monitoring, and has great practical value.

2.Identification of the Product

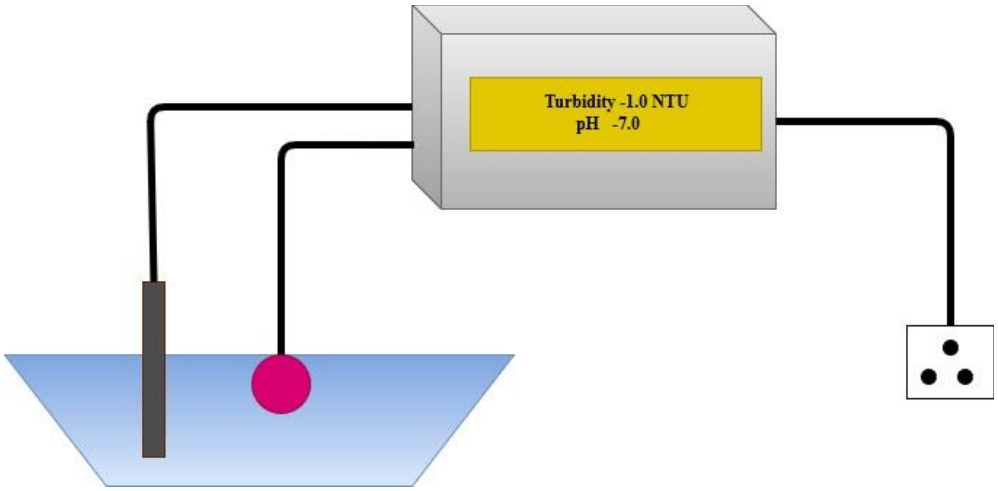


Figure1:Structure of the node for one stage

First you have to place your three sensor nodes at suitable place according to the water treatment plant is adopted.Then we have to supply power to the node modules separately.

Then turbidity sensor and pH sensor are put into the water sample of relevant treatment stage output water. Then let water to flow.

3. System Overview

Following you can see final system of this product.

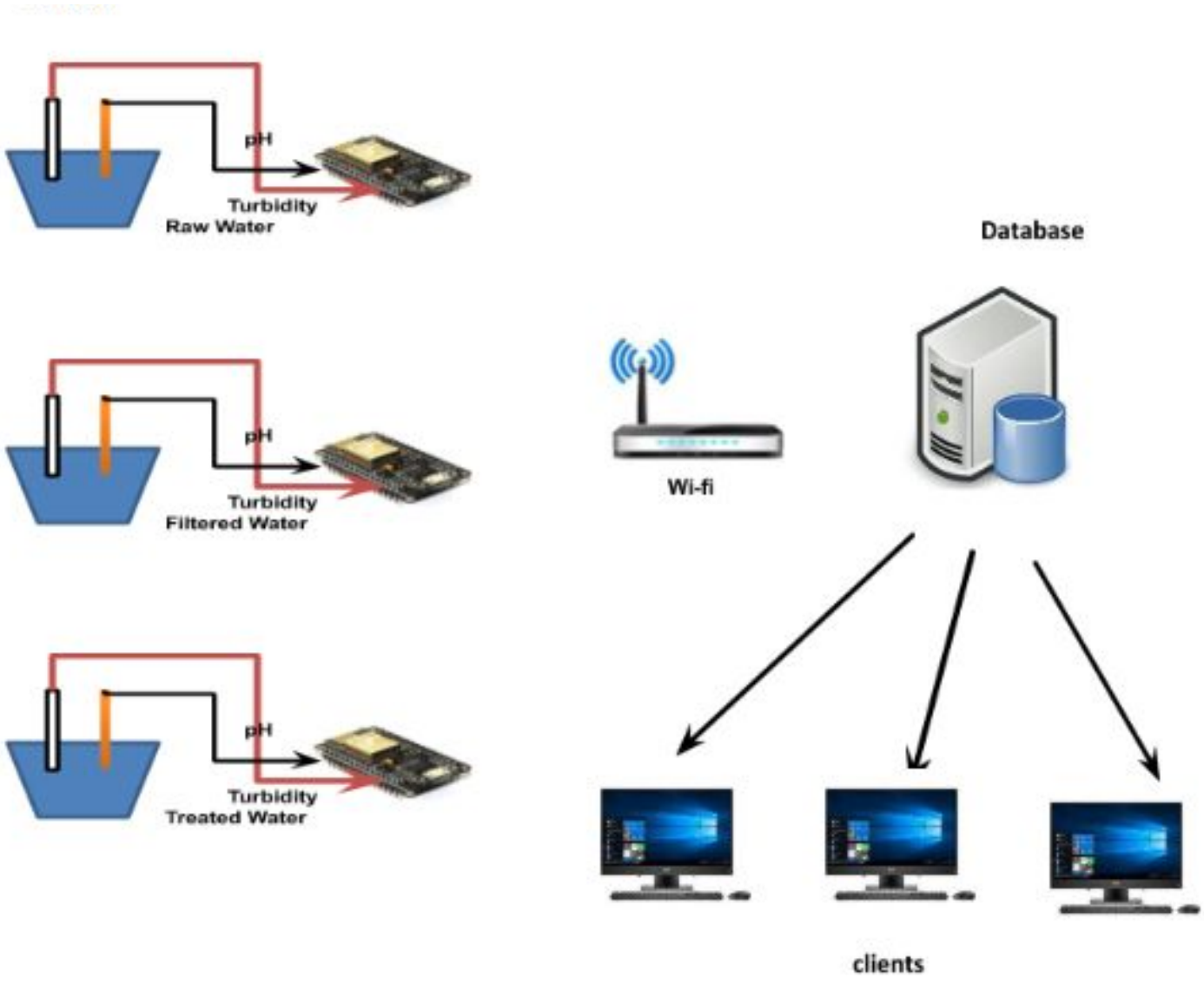


Figure2: Product establishment of the water treatment plant

4.Specifications

4.1 pH sensor

In this hardware system we have used an analog pH meter, specially designed for Arduino controllers and has built-in simple, convenient and practical connection and features. It has an LED which works as the Power Indicator, a BNC connector and PH2.0 sensor interface. To use it, just connect the pH sensor with BNC connector, and plug the PH2.0 interface into the analog input port of any Arduino controller.

As this is calibrated and pre-programmed, you will get the pH value easily.

Specifications:

- Module Power : 5.00V
- Module Size : 43mm×32mm
- Measuring Range:0-14PH
- Measuring Temperature :0-60 ℃
- Accuracy : ± 0.1pH (25 ℃)
- Response Time : ≤ 1min
- pH Sensor with BNC Connector
- PH2.0 Interface (3 foot patch)
- Gain Adjustment Potentiometer
- Power Indicator LED
- Cable Length from sensor to BNC connector:660mm

How to use pH sensor:

First you should connect the pH sensor, as shown in the above product. Here,for the protection of the sensor, its sensitive end is covered by a lid. So, then remove the lid and put it into the particular solution. You should provide 5V power, otherwise sensor may be burned in high voltages. If there is not loose connections you will get correct values.

4.2 Turbidity sensor

In this hardware system we have used the gravity arduino turbidity sensor which detects water quality by measuring the levels of turbidity, or the opaqueness.Turbidity sensors are used to measure water quality in rivers and streams, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research and laboratory measurements. This liquid sensor 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.

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

How to use Turbidity sensor:

First you should connect the Turbidity sensor, as shown in the above product. Then put the electrode into the particular solution. You should provide 0-5V power, otherwise sensor may be burned in high voltages. If there is not loose connections you will get correct values.

4.3 Node MCU ESP8266

Moule used: ESP8266 NodeMCU CP2102 board

The nodeMCU module ESP8266EX is often integrated with external sensors and other specific devices through its GPIOs; codes for such applications are provided in examples in the SDK.

Specifications:

- Embedded with Tensilica Xtensa® 32-bit LX106 RISC micro controller
- operates at 80 to 160 MHz adjustable clock frequency
- 128kB internal RAM
- Flash Memory: 4MB external flash (for program and data storage)
- 802.11b/g/n Wi-Fi transceiver
- operating voltage range:3V to 3.6V
- On-board 3.3V 600mA regulator
- 80mA Operating Current
- 20 µA during Sleep Mode

Power to the ESP8266 NodeMCU is supplied via the on-board MicroB USB connector. Alternatively, if you have a regulated 5V voltage source, the VIN pin can be used to directly supply the ESP8266 and its peripherals.

WARNING

The ESP8266 requires a 3.3V power supply and 3.3V logic levels for communication. The GPIO pins are not 5V-tolerant! If you want to interface the board with 5V (or higher) components, you'll need to do some level shifting.Otherwise nodeMCU board may burn.

4.4 Web Application

You can get into our designed website, Automated Water Quality Monitoring system using

https://www.automatedwaterqualitymonitoringsystem/

When you get into the site your web interface should seem like the following image.

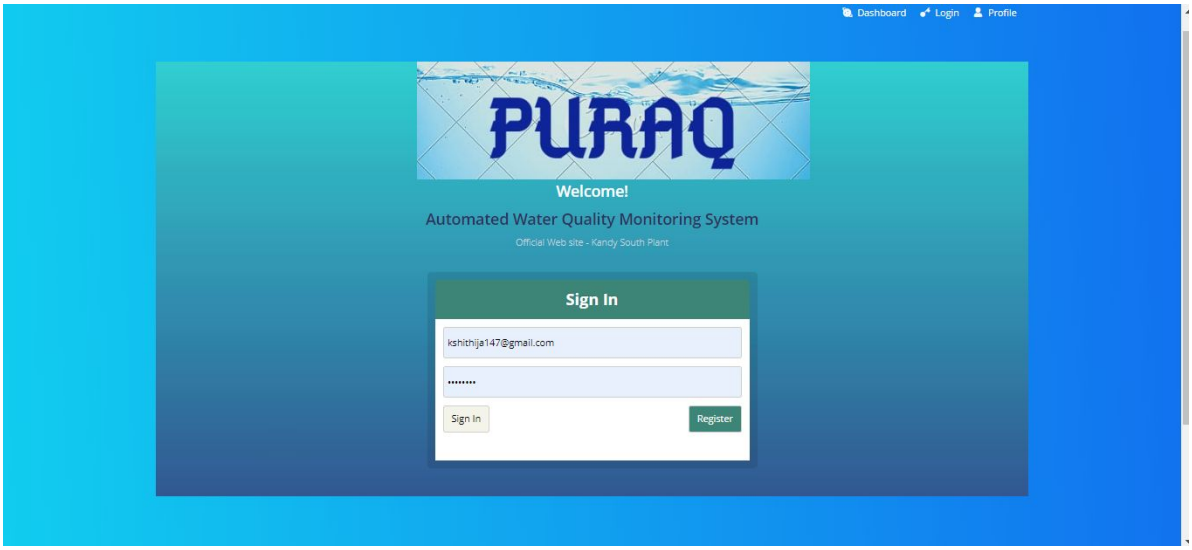


Figure3: Initial page of Automated water quality monitoring system

If you are not registered to the system, you can register here and create your own account by providing your email and password. Then to follow the system first you should log into the system by entering your email and password that you previously used to register.

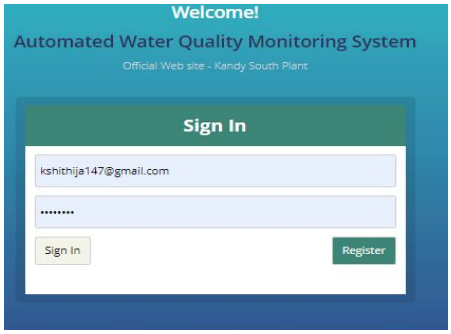


Figure4:Register to the system

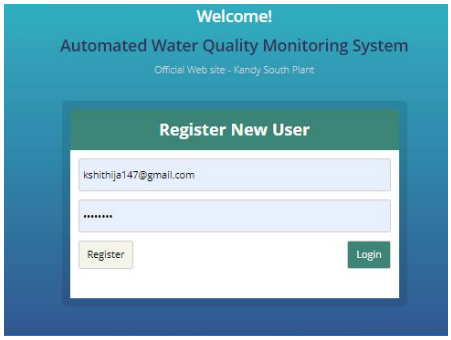


Figure5:Sign in to the system

After sign in to the system, you will get into dashboard, where you can see all of the details.

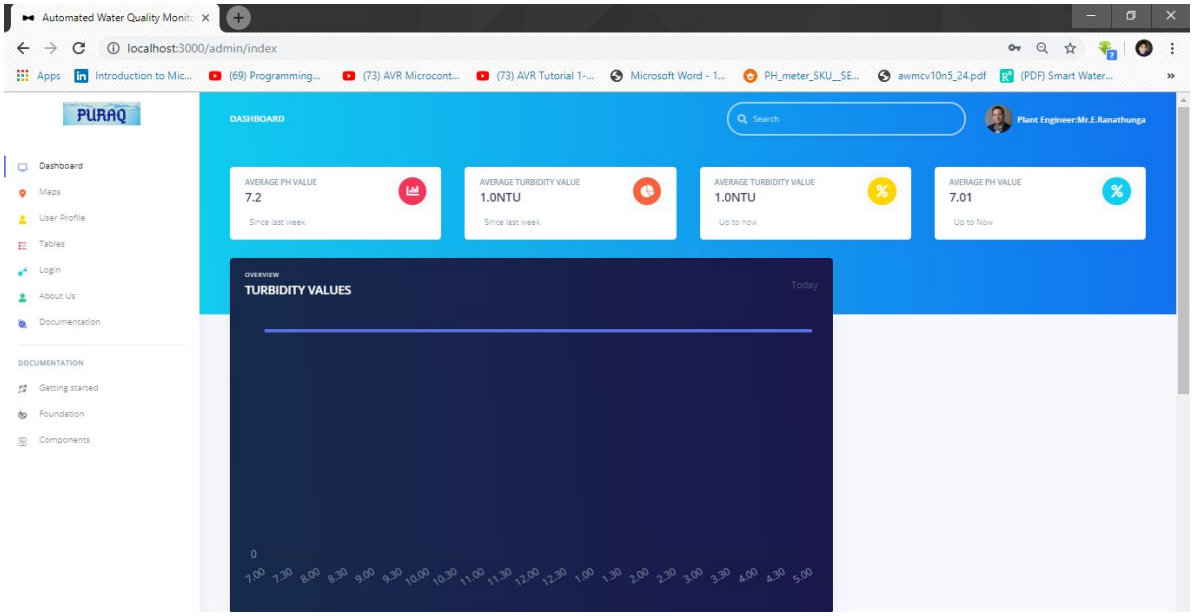
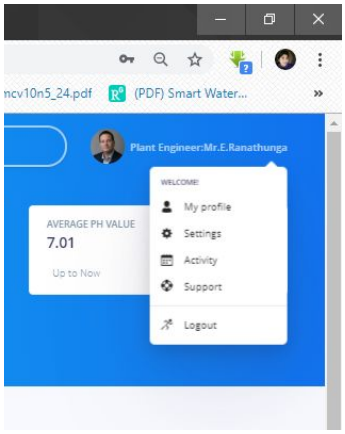


Figure6:Dashboard

This is the system dashboard. By using side navigation bar, there are Login page,Maps,User Profile,Tables,About Us page and Documentation page. And in the header of the page you can see daily basis and weekly basis average pH and Turbidity values.
In dashboard page,it shows graphical variations of daily pH and Turbidity values using two line graphs. The top bottom corner drop down menu bar can be used to logout from the system.



Logout button

Figure7: Drop down menu bar

In table page, there is two separate tables for pH and Turbidity values. If you make connections correctly and do the experiment, tables will be realtime updated.

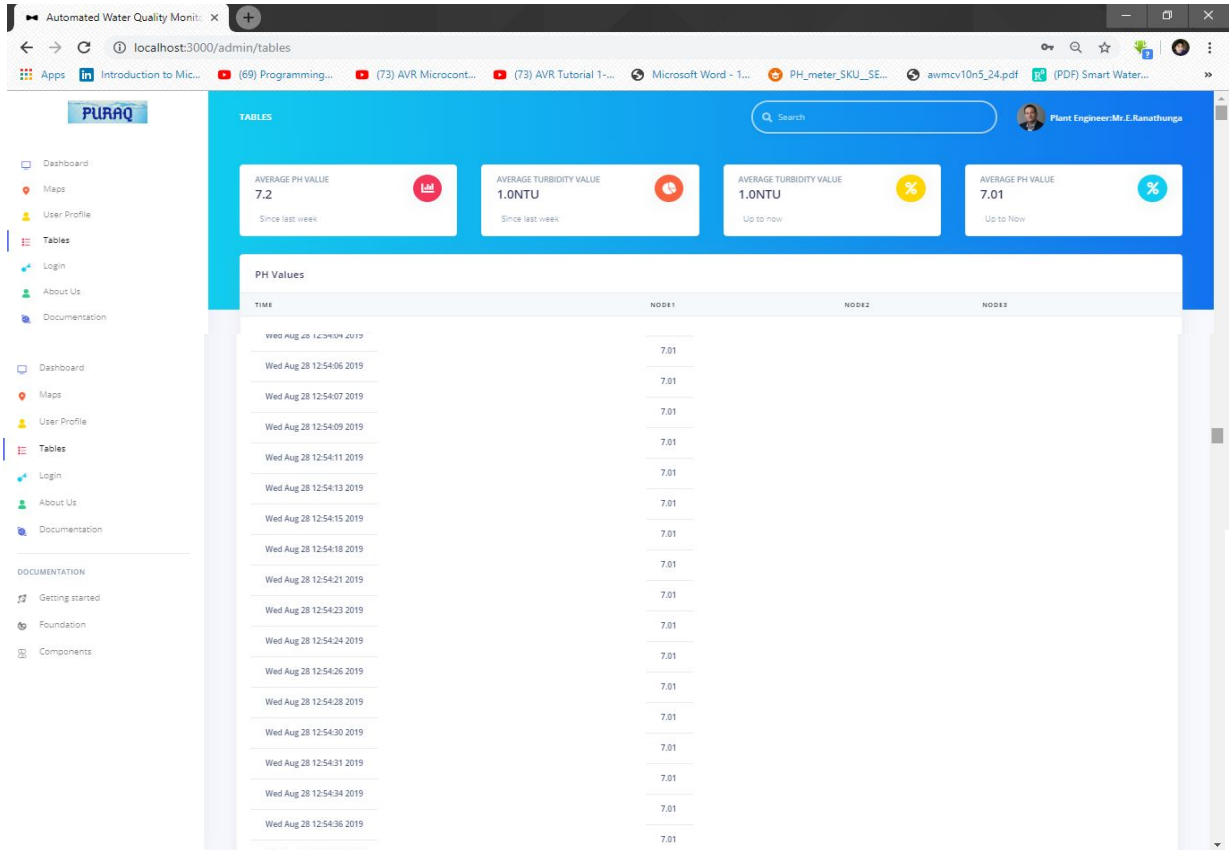


Figure8: Table Page

In documentation page, You can get an idea of Standard values for each stage.Here we have implemented to give an alert,if measured sensor values variate out of particular range.

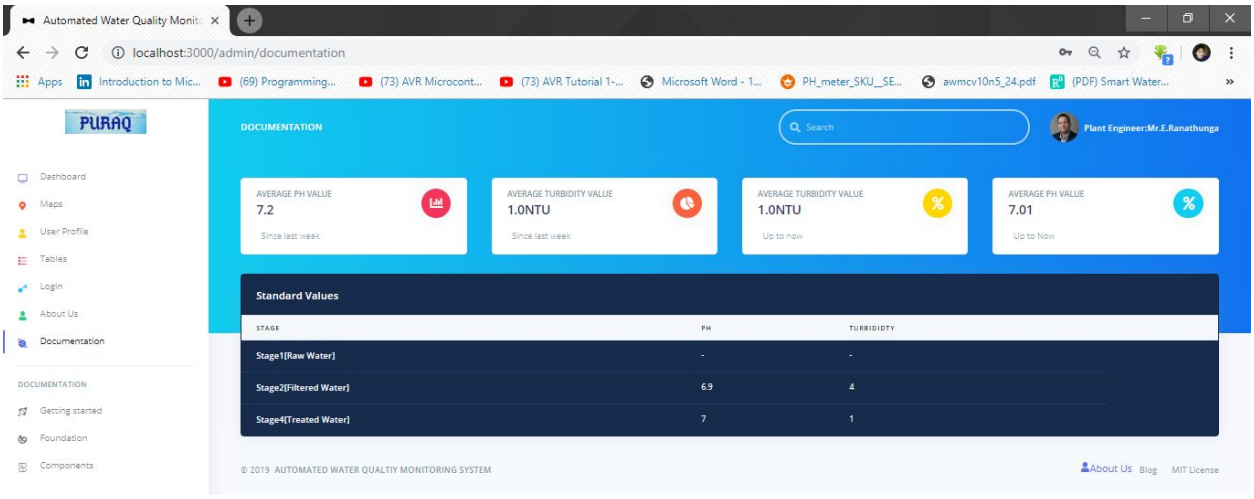


Figure9: Documentation page

In About us page, it shows contact details of the relevant plant and about water treatment stages step by step.

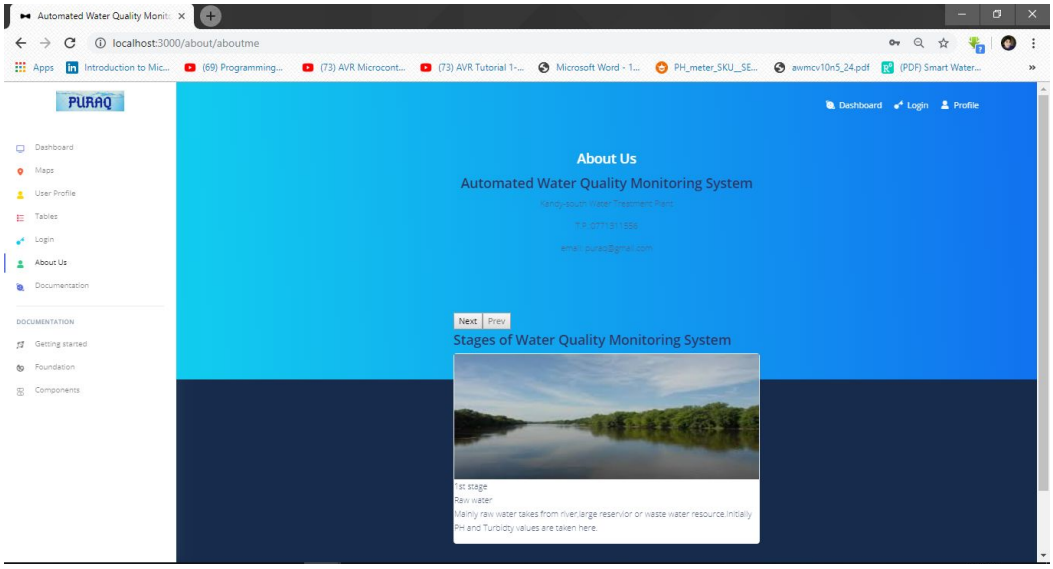


Figure10: About Us page

The Maps page is included a map with other water treatment plants in the area. By that user can view some more details of other plants too.

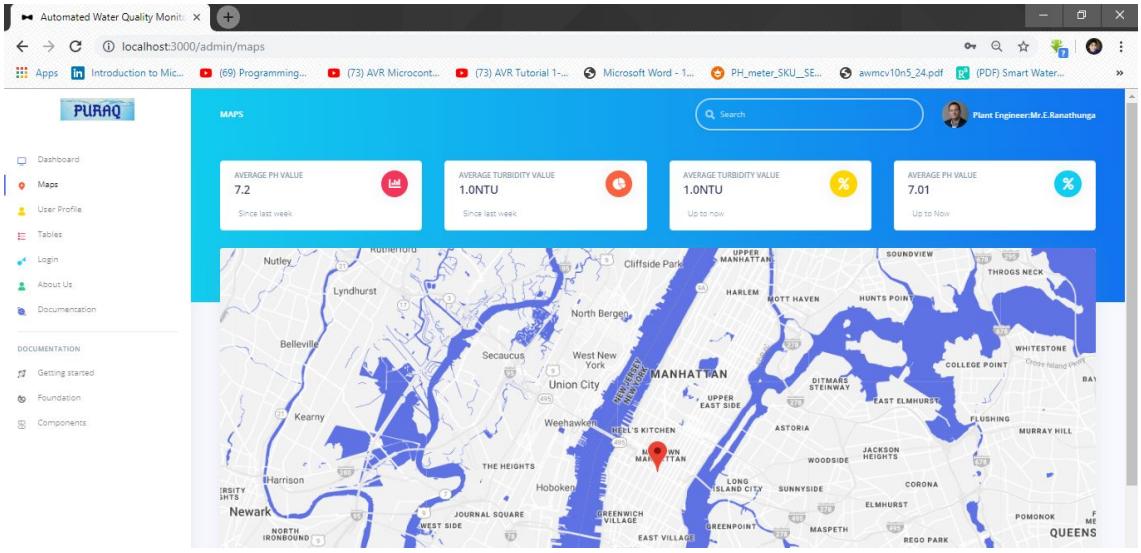


Figure11: Maps page

4.5 Data Security

We have consider the security of the data, to achieve this we have use raw sensor data encryption method and to restrict unauthorized access to the system,we have use user authentication feature in the web site.

4.5.1 Error messages

When considering authentication, if you enter wrong details when sign in or if you are going to re-registered to the system, you will get error messages.Only registered person can access to the system.

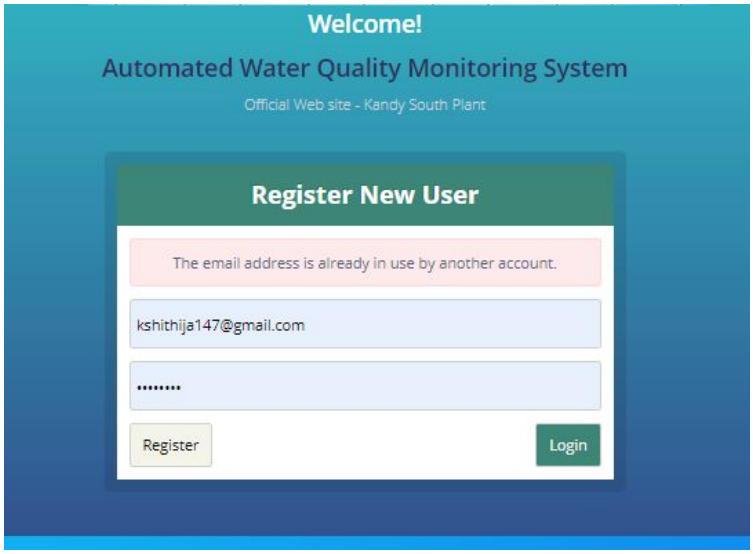


Figure12: Getting an error message

4.6 Alert message/notification

The system is designed such that it automatically generate alert message with changes of readings compared with standard turbidity and pH values.

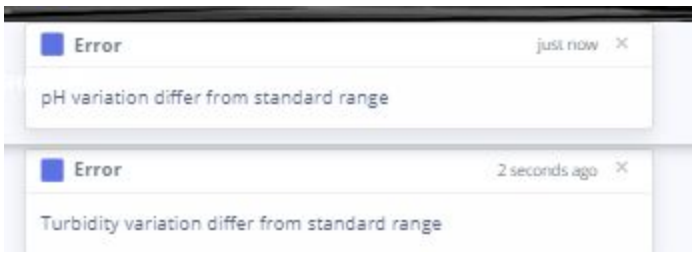


Figure13: Notification message