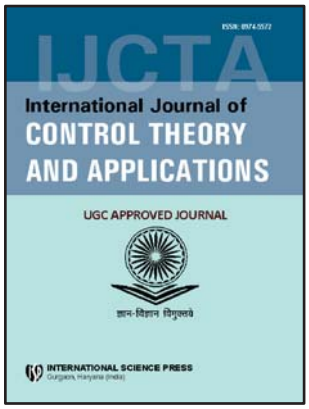

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Water Purity Monitoring and Purification

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Abstract: The existing water filtering models do not have the monitoring and purification techniques together. In our proposed model we would be combining both monitoring and purification techniques. The first phase of filtering is passing the water through candle filter which filters some ions (iron,potassium,etc.), mud, sand and other heavy sediments. The second phase is to monitor the pH and dissolved oxygen levels using the pH sensor and dissolved oxygen sensor respectively along with some chemical compounds. Our proposed model uses the idea that the purity level of the water is an important parameter. If the water pH level and oxygen level reaches the desired value, the signal is fed to the controller and the necessary procedure will be carried out . The whole working is controlled using Arduino Mega.

Keywords: *IOT, Arduino Mega, Monitoring, Purification.*

1. INTRODUCTION

Water is a crucial part for survival in everyday life. Due to various environmental situations, management of water and conservation of water is vital for human survival. Therefore, monitoring the quality of water quality is necessary which includes some chemical parameters like pH, dissolved oxygen, and different ion levels. We propose a water monitoring and purification system that measures pH level, dissolved oxygen level and ions levels in real time and purifies the water.

The existing water filtering models do not have the monitoring and filtering techniques together.

The proposed model can also be used in agricultural fields and various industries. The first phase of monitoring the impurities in water is done by measuring ph level and dissolved oxygen using Arduino programming in real time.

1.1. Existing Systems and Their Drawbacks

The existing systems only purify the water and do not monitor the purity of the water. It does not inform about the pH level, dissolved oxygen level and various ions like iron, potassium, etc. present in water.

1.2. Proposed System and Its Merits

We propose a water monitoring and purification system that measures pH level and dissolved oxygen level in real time and regulates these levels depending on the required level fit for uses.

2. HARDWARE COMPONENTS

The main aim of the project is to set up a device which cannot only filter out the ions but also monitor and rectify the pH and dissolved oxygen levels accordingly using respective chemical compounds namely sodium hydroxide and alum. The hardware components to be used are Arduino Mega, D.C. Motor, Relays, Oxygen and pH Sensors, L.E.D. Indicators, Solenoid Valves, Candle Filter, Air Pump and for the construction of the mechanical structure we would use Conical Funnels and Pipes.

2.1. Arduino Mega 2560

The Arduino Mega 2560, an open source platform, is used as a microcontroller. It consists of 54 digital input/output pins and 16 analog inputs. It contains everything to support the microcontroller. It can be simply connected to a computer with a USB cable. The Arduino takes it's input from sensors and processes the data which can be used for controlling the motors or any physical process.

2.2. DC Electric Motor

12V DC Electric Motor :

Voltage : 3-24 V

Speed : 2000-30000rpm

Power : 2-30W

Brand name : Leison motor

DC electric motor is used in order to rotate the stirrer so that the chemicals namely Sodium hydroxide (NaOH) and Alum can be mixed in order to change the pH levels of water and get pH = 7(neutral) depending on the acidity or basicity of water.

2.3. Electromechanical Relays

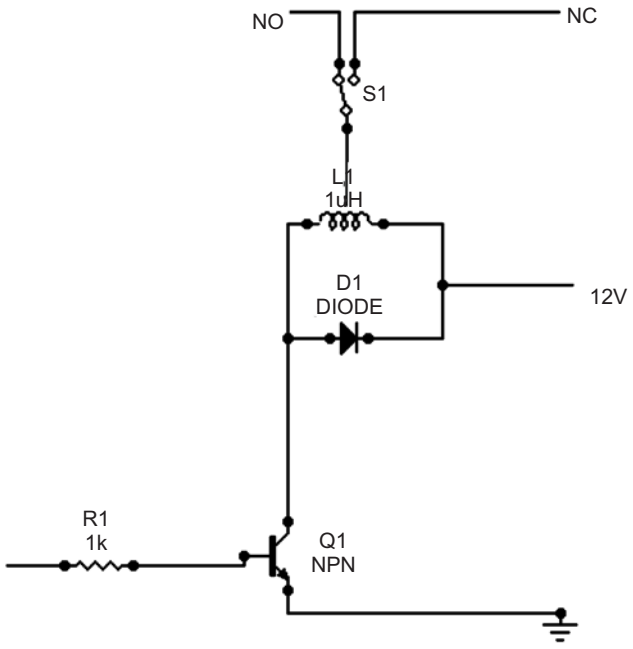

Figure 1: Relay Circuit

Relays, electromagnetic switches, provides contact between 2 mechanical elements. Relays consist of a coil which work on 12V DC power supply and provide DPDT action as an output. The pH and Oxygen sensors, the solenoid valves and the air pump are all connected to the relays and then these relays are connected to the pins of the Arduino Mega 2560. In total, there are 5 relays to be used in the whole system.

2.4. pH Sensor

The pH sensor measures the pH of different solutions in various process applications. It is designed to perform in the harshest of environments, including applications that poison conventional pH sensor. In our setup, we would suspend the pH sensor in water and the pH level of water will be displayed.

If pH < 7, water is acidic so NaOH is added in order to make the water neutral(pH = 7). Similarly if pH > 7, water is basic so Alum is added to make the water neutral. The PHE-45P is the pH sensor which we have used in our system. The PHE-45P pH sensor is designed for industrial and municipal process applications. Mounting options include flow-through, submersion, insertion or integral mount to the Omega PHTX-45 pH monitor.

2.5. Power Supply

The Arduino Mega 2560 can be simply connected to a computer with a USB cable. The power source is selected automatically. There are 2 power supply circuits , one is a 5V supply for the Arduino board and the other one is 12V supply used for DC electric motor.

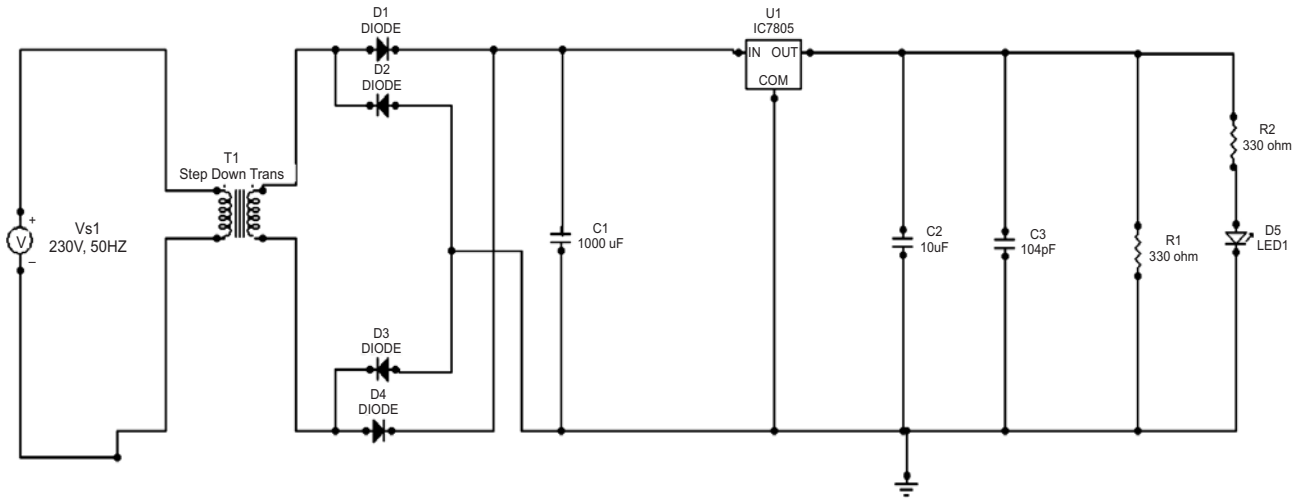

Figure 2: Power Supply Circuit

Figure 3: Power Supply Circuit on PCB

2.6. Candle Filter

Table 1
Comparison of Different Filters

RO Purifiers	*UV Purifiers*	*Candle Filters*
RO purifiers require electricity to clean water.	Require electricity to clean water.	Removes pathogens turbidity and suspended solids.
These waste a lot of water during the purification process.	Do not remove dissolved impurities like fluoride, arsenic, lead, nitrates.	Effective for the removal of viruses and iron.
Maintenance can be costly.	Maintenance can be costly.	Improves taste, smell, colour of water and keeps the water cold and safe.
		Cheap, simple and easy to use and clean.

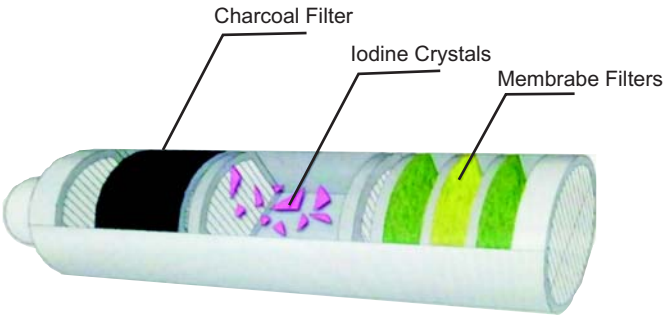

Figure 4: Candle Filter

The candle filter filters some ions like iron, potassium, etc., mud, sand and other heavy sediments. The candle filter is connected to the main container via pipe and there is a solenoid valve used to monitor the flow rate of the water from the candle filter to the main water container.

2.7. Submersible Air Pump

There is an air pump attached at the lower end of the container to maintain proper oxygen level (20mg/lt). If the oxygen level is less than the required amount then the air pump is switched on to improve the oxygen level of water up to the standard reference value. In the above case Arduino Mega is used to program and monitor the dissolved oxygen levels and accordingly air pump is switched on or off.

Figure 5: Air Pump

2.8. Oxygen Sensor

The simplest method for measuring dissolved oxygen levels is with a dissolved oxygen meter and sensor. In addition to the standard analog output, various technologies are available that provide a digital output. Similar to the pH sensor, the oxygen sensor is also suspended in the water and the DO level of water will be displayed. Then depending on the DO level, the air pump will be monitored

Figure 6: Oxygen Sensor

3. WORKING

When water is passed through the candle filter, all the ions, sediments, mud and other impurities get filtered and the water, free of all the above elements is passed into the container through solenoid valve. This valve regulates the flow of water into the container. There are 2 conical funnels consisting of sodium hydroxide(NaOH) and Alum respectively which are used to control pH level of the water. If pH < 7, water is acidic so NaOH is added in order to make the water neutral(pH = 7). Similarly if pH > 7, water is basic so Alum is added to make the water neutral. There is an air pump attached at the lower end of the container to maintain proper oxygen level(20mg/lt). If the oxygen level is less than the required amount then the air pump is switched on to improve the oxygen level of water up to the standard reference value. In both the above cases Arduino Mega is used to program and monitor both pH and Dissolved oxygen levels. A pH level and dissolved oxygen sensors are used to indicate the respective levels of water and on comparison with the set programmed values, errors in the levels are analysed by the Arduino. Depending on the errors, the chemicals are released continuously and air pump is activated till the time the desired conditions are not fulfilled. The stirrer is rotated continuously to mix the chemicals properly. At the outlet of the container, 2 LEDs are fixed to indicate the desired water conditions. If RED LED glows, the water has not attained the desired levels and if GREEN LED glows, the water has attained the desired levels and can be used for various purposes

4. RESULT AND DISCUSSION

The proposed model discussed in this paper can monitor the different parameters like pH level and dissolved oxygen level of water. It provides a medium to monitor and control the pH and dissolved oxygen levels. Arduino Mega 2560 has been used for programming the whole process system. Since it is a closed loop system, in case of any errors, the process will be repeated accordingly. The different electric circuits used in this system which are the relays and power supply are adequate.

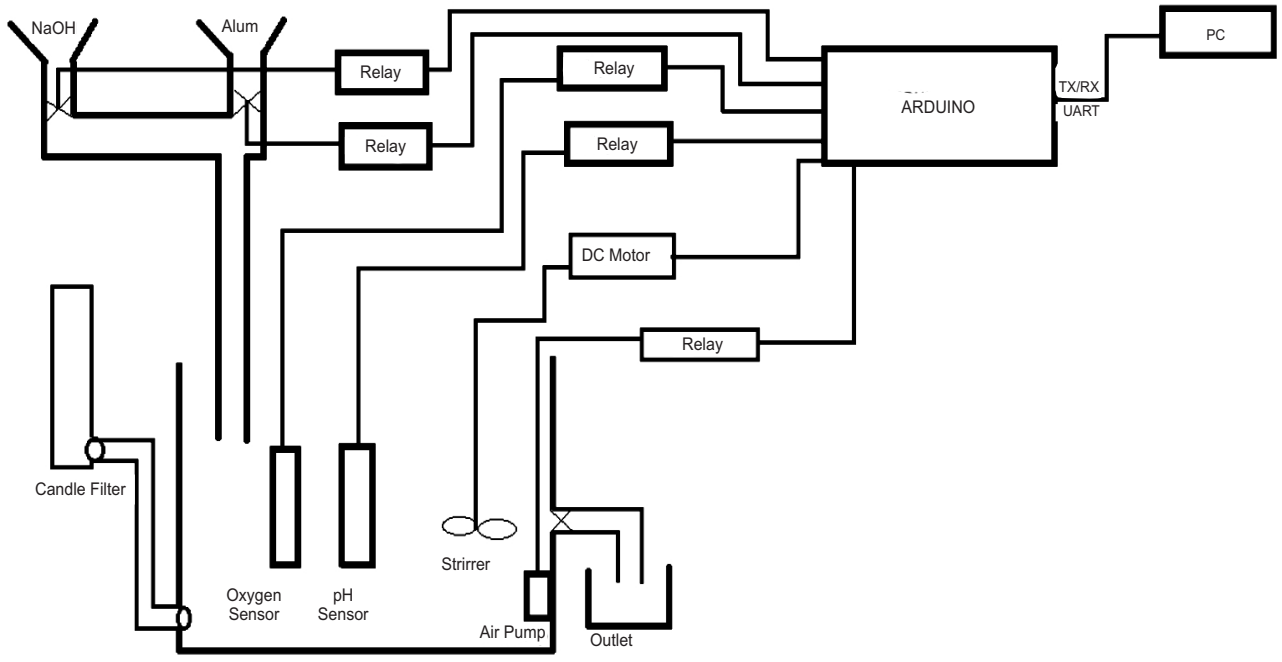

Figure 7: Schematic Representation of the Working Model

5. OUTPUTS OF SIMULATION

5.1. ACIDIC

Voltage : 3.58	pH value : 6.83
Voltage : 3.59	pH value : 6.85
Voltage : 3.59	pH value : 6.86
Voltage : 3.59	pH value : 6.88
Voltage : 3.60	pH value : 6.89
Voltage : 3.60	pH value : 6.91
Voltage : 3.60	pH value : 6.91
Voltage : 3.61	pH value : 6.93
Voltage : 3.61	pH value : 6.94
Voltage : 3.61	pH value : 6.95
Voltage : 3.62	pH value : 6.96

Figure 8: Acidic Scale

5.2. NEUTRAL

Voltage : 3.63	pH value : 7.00
Voltage : 3.63	pH value : 7.00
Voltage : 3.63	pH value : 7.00
Voltage : 3.63	pH value : 7.00
Voltage : 3.63	pH value : 7.00
Voltage : 3.63	pH value : 7.01
Voltage : 3.63	pH value : 7.00
Voltage : 3.63	pH value : 7.01

Figure 9: Neutral Scale

5.3. BASIC

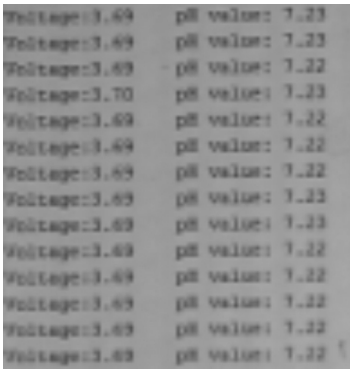

Figure 10: Basic Scale

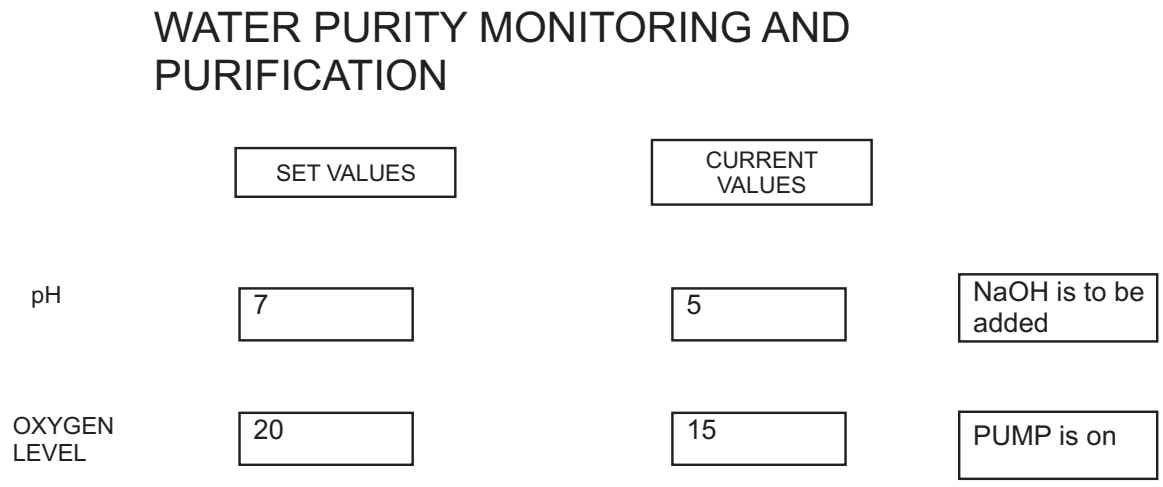

Figure 11: Operation taking place when pH and oxygen levels are less than the set values

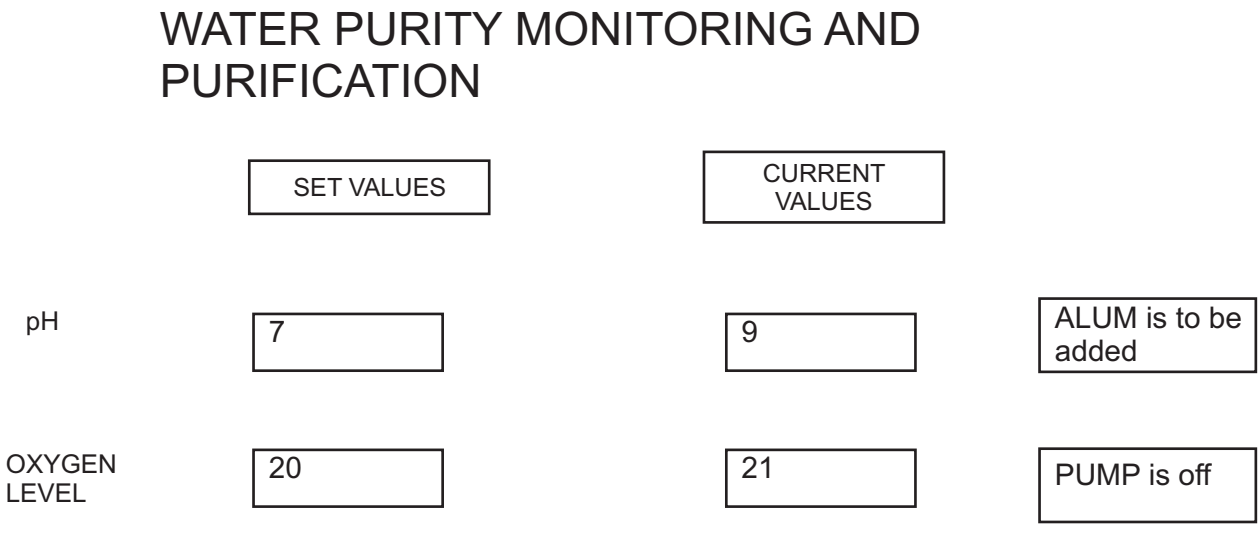

Figure 12: Operation Taking place when pH and oxygen levels are less than the set values

6. CONCLUSION

The proposed model discussed in this paper can monitor the different parameters like pH level and dissolved oxygen level of water. It provides a medium to monitor and control the pH and dissolved oxygen levels. Arduino Mega 2560 has been used for programming the whole process system. Since it is a closed loop system, in case of any errors, the process will be repeated accordingly. The different electric circuits used in this system which are the relays and power supply are adequate.

7. FUTURE WORKS

The system can also be used if an IOT module is also connected to the Arduino for large scale purposes. The user would receive an alert on the smartphones in case of any monitoring problems or errors in the pH and DO values. Also, the TDS(Total Dissolved Salts) module can be integrated in order to monitor all the salts . At the end, an additional purifier can also be installed in order to ensure if the water is free from all the ions and heavy sediments.

8. ACKNOWLEDGEMENT

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