Measurement of pH Value by using RGB Sensor

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Abstract - *Realtime pH monitoring of solutions is must in the system where accurate chemical condition are required. The pH reading can be helpful for tracking the ions, biological functions and microbial activity inside a chemical solution. pH sensors are also readily available in market consisting of pH glass electrode and a silver chloride reference electrode for using them with several IoT circuits, but the life of the electrode is about 1-2 years and the sensor itself are quite costly. The pH measured using RGB sensor consist of a RGB sensor which works by shining a white light on the solution and then recording the reflected color. The reflected color is then matched with the proper RGB code combination and appropriate results are generated. The experiment has shown that the RGB sensor gives accurate measures of pH which is equivalent to an actual pH sensor reading.*

Key Words: **RGB sensor, pH, microcontroller, Arduino, relay, pump, container.**

1. INTRODUCTION

pH monitoring is generally done for finding out the relative amount of hydrogen and hydroxyl ions in the water. When more hydrogen ions are present then the solution is treated as acidic and more hydroxyl ions are present then the water is treated as basic. Since low or high pH level can disrupt the delicate balance in living organisms, proper diagnosis is necessary. In human body, the blood should have a pH in between 7.35 to 7.45 more or less then the mentioned can lead to either acidosis or alkalosis. Similarly in agriculture, especially in Hydroponics where plants are grown mainly in water, proper pH level should be maintained for sustaining the crops in that environment.

1.1 pH Measuring Techniques

There are multiple methods of measuring pH.

• The common practice to measure pH is using a pH meter, which involves a pH-sensitive electrode (made of glass) and a reference electrode.

• Acid-base indicators changes color of the solution in response to different pH values. Litmus paper are used for fast and accurate measurements.

• A colorimeter used to measure the pH of a solution or a sample. A vessel is filled with a specimen and a reagent is added to give a pH-dependent color change. The color is compared against a chart to see the pH value.

2. RGB pH Sensor

In the development of this method, related theory and also the principles of system design were involved to fulfill the wants of users. The objective of this innovation is to measure pH effectively based on the readings obtained from the sensors.

2.1 Hardware

The following are the components that are used in this proposed in this RGB pH Sensor:

1.Arduino Nano

In this system, Arduino Nano is a simple microcontroller that provides an environment to create functional and creative projects. Arduino Nano takes data from RGB sensor in the form of RGB coded values and map that value according to the predefined pH value inside the code.
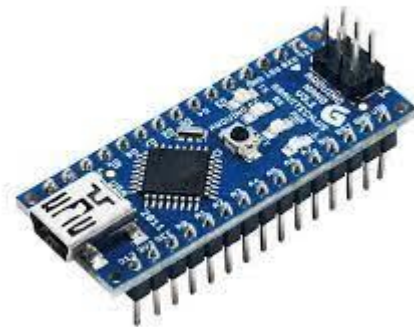

Fig -1: Arduino Nano

2. RGB sensor

RGB sensor works by shining a white light on the solution and then recording the reflected color. For example, if the solution is of green color, RGB sensor will give output as RGB (0,128,0) which is then mapped with its respective pH value which would be 7 as per pH color scale.
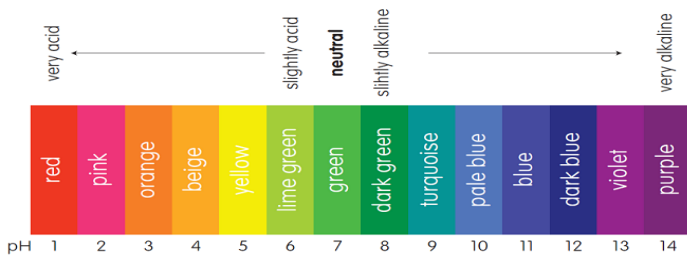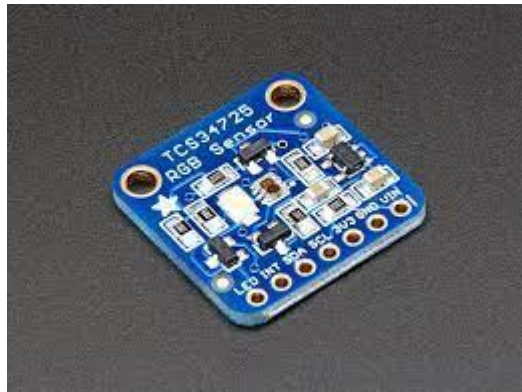
Fig -2: pH Scale

Fig -3: RGB sensor

3.Pump

Pump are used to introduce buffer solution and the sample solution inside the vessel.

Fig -4: Pump

4.Motor

A small motor is present at the bottom of the vessel which rotates to mix the buffer solution with the sample solution.

5.Relay

Relay is used to toggle the pump on or off.

Fig -5: Relay

2.2 Software

1.Arduino IDE

For programming the sensors Arduino IDE is an open-source Software (IDE) which makes it easy to write code and upload it to the board.
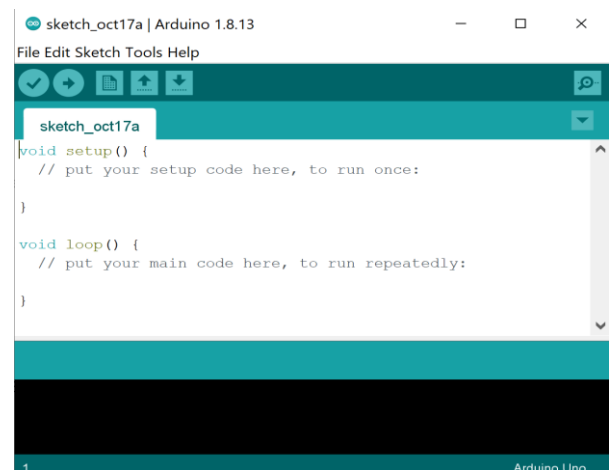

Fig -6: Arduino IDE

2.3 Experimental Setup and Results

In the block diagram of this proposed system Arduino nano is the heart of the system and all the other sensors data is collected via Arduino Nano. The stored data is then displayed to the Arduino IDE serial monitor.
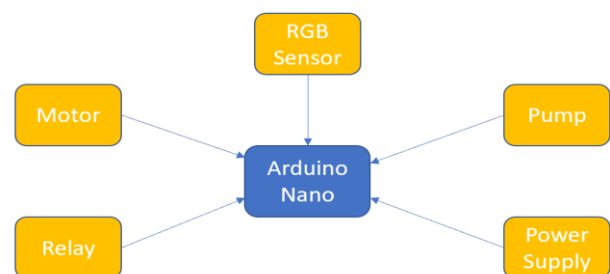

Fig -7: RGB pH Sensor Block Diagram

The proposed system consists of various steps which begins as follows: First of all, pH buffer solution and the sample solution is introduced in the pH measuring chamber with the help of pump which is turned on or off by the relay. After introducing the solution, the motor present at the bottom of the chamber mixes the pH buffer solution with the sample solution, after that RGB sensor senses the color of the solution, gives RGB code and then matches that RGB code

with the respective color on the pH scale. The result is then displayed on the Serial Monitor of Arduino IDE Software.
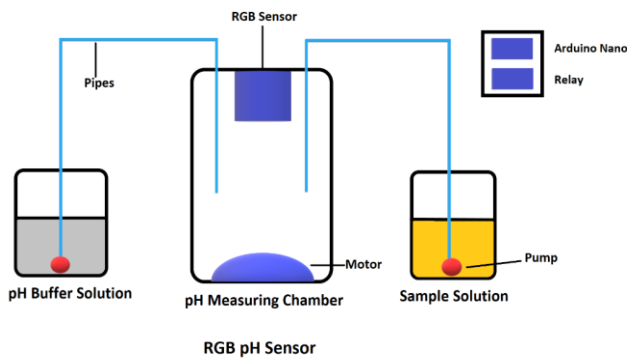

Fig -8: RGB pH Sensor

3. Applications

1. **Agriculture**

   pH measurement is quite useful in Hydroponics and Aquaponics which is a field of agriculture where plants are grown mainly inside water.

2. **Dairy Industry**

   pH control in dairy industry is must for proper fermentation and quality of dairy products.

    Gelatin and Glue Manufacturing

   pH should be maintained at a proper level for quality and consistency of Gelatin and Glue.

3. **Laundries**

   The efficiency of Soap and Detergents improves by proper pH control.

4. **Printing**

   The pH of ink should be controlled to assure proper penetration and drying of ink

4. Advantages

• Requires cheaper components than the pH sensor/meter.

• It is economical.

• All the components are portable so can be carried easily.

5. Conclusion

As measurement of pH is quite important in each and every aspect, this system will be helpful for measuring the pH efficiently and at a lower cost than the traditional pH sensor/meter.

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