# BEVERAGE QUALITY CHECK

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***Abstract*--This study presents a beverage quality analyzer system using an Arduino Uno microcontroller board, integrating multiple sensors to measure the parameters like pH, temperature, dissolved oxygen, turbidity, total dissolved solids and conductivity of the beverage. The goal is to provide real- time, accurate measurements for environmental monitoring, water treatment, and industrial processes, enabling proactive management and timely decision-making. The sensors are calibrated and programmed for precise and reliable measurements. The beverage quality analyzer system processes sensor data using algorithms and conversion equations, incorporating regulatory threshold values. It triggers alerts or notifications when parameters exceed defined thresholds, ensuring accurate, reliable, and effective monitoring. Future enhancements include additional sensors, communication expansion, and user feedback. The experiment evaluated the performance and accuracy of beverage quality analyzers in industrial applications, testing samples like water, chemical solutions, and petroleum-based beverages. Results showed varying accuracy and reliability, emphasizing the importance of calibration procedures, sensor technology, sample handling, and software algorithms. Recommendations for optimizing analyzer performance included regular calibration, proper sample preparation, and periodic validation. These findings contribute to improving beverage quality analysis in industrial settings and assist professionals in making informed decisions about the selection and utilization of analyzers.**

**Keywords: Arduino Uno; sensors; system; quality; precise; accurate.**

## I. INTRODUCTION

*A. Objective:*

The beverage quality analyzer experiment's goal is to evaluate a particular beverage sample's quality through in-depth analysis. The experiment seeks to test and assessnumerous characteristics including pH, conductivity, dissolved oxygen, turbidity, particular ions or compounds, temperature, and more using the beverage quality analyzer. The experiment ensures accurate and interpreted. This experiment provides important information on the beverage's quality, enabling educated decisions about whether it is suitable for purposes or whether additional processing or treatment is required.

*B. Motivation:*

The crucial significance of assuring the safety, dependability, and appropriateness of beverages in numerous industries and applications is what spurred researchers to undertake a beverage quality analyzer experiment. The quality of beverages has a direct impact on public health, legal compliance, and overall operational effectiveness in a variety of industries, including food and beverage processing, pharmaceutical manufacture, water treatment, and environmental monitoring. Insights about the composition, purity, and properties of the beverage samplecan be learned through experimentation, enabling knowledgeable decisions to be made about its suitability for use, treatment, or additional processing. Additionally, the experiment can support research and development initiatives by promoting creativity, optimization, and the creation of better beverage formulations or procedures. Overall, the motivation lies in the pursuit of excellence, compliance, and advancement in diverse fields that depend on the quality and integrity of beverages.

*C. Background:*

The goal of the experiment with the beverage quality analyzer isto precisely measure and evaluate the quality of beverage samples, which are essential in many different businesses, including those that deal with food and beverage, medicines, environmental monitoring, and water treatment. The safety of products, regulatory compliance, and operational effectiveness are all directly impacted by the quality of beverages. For quality control, process optimization, troubleshooting, and decision-making, researchers want a thorough understanding of the composition, purity, and properties of beverage samples. This experiment expands on well-established beverage analysis principles and makes use of the capabilities of the beverage quality analyzer, improving comprehension and control, advancing industry standards, and providing secure goods and services.

## II. LITERATURE SURVEY

representative results through thorough calibration and appropriate sample preparation. To make inferences about the beverage's purity, composition, concentration, orother pertinent attributes, the data is

*A. Beverage quality analyzer: a review of currenttechnologies*:

Beverage quality analyzers have experienced significant advancements, enabling more accurate and efficient analysis of samples. Modern technologies, such as spectrophotometry, electrochemical sensing, and optical sensors, enable precise chemical concentration determination, rapid measurements of parameters like pH, conductivity, and dissolved oxygen, and real-time monitoring of compoundsand particulate matter. These advancements revolutionize the field of beverage analysis, enhancing applications in industries like healthcare, environmental monitoring, and manufacturing.

*A. The use of beverage quality analyzer in the food andbeverage industry:*

Beverage quality analyzers are essential in the food and beverage industry, ensuring product safety, compliance, and quality. They assess parameters like pH, conductivity, dissolved oxygen, turbidity,and chemical components, identifying contaminants, impurities, and deviations from specifications. They monitor critical processes, control adherence to standards, and verify productlabeling claims. This ensures consumer safety, regulatory compliance, and high-quality products that meet or exceed customer expectations.

*B. Beverage quality analyzers for thepharmaceutical industry:*

Beverage quality analyzers are essential in the pharmaceutical industry, ensuring the safety, efficacy, and compliance of beverage-based products. They assess critical parameters like pH, conductivity, and chemical components, identifying impurities, contaminants, and deviations from specifications. These analyzers monitor stability, shelf life, sterilization effectiveness, and medication dosing, supporting pharmaceutical manufacturers in meeting regulatory requirements and producing high-quality products.

*C. Beverage quality analyzers for the environmental industry:*

Beverage quality analyzers are crucial in the environmental industry for monitoring and assessing water and wastewater quality. They measure parameters like pH, conductivity, dissolved oxygen, turbidity, and contaminants, evaluating overall water quality, pollution sources, and treatment effectiveness. These analyzers help ensure compliance with regulations, protect ecosystems, and detect harmful substances like heavy metals, pesticides, and organic pollutants.

*D. Beverage quality analyzers for the energy industry:*

Beverage quality analyzers are crucial in the energy industry, enabling precise and efficient analysis of beverage samples in various processes like oil and gas exploration, refining, transportation, and renewableenergy sectors. They assess parameters like viscosity, density, acidity, water content, and chemical components,ensuring the purity, stability, and performance of energy-related fluids. Beverage quality analyzers contribute to operational efficiency, reduce equipment wear, and prevent potential malfunctions. They also help maintain environmental compliance by monitoring and controlling beverage waste and emissions.

*E. Beverage quality analyzers for the medical device industry*

Beverage quality analyzers are of utmost importance in the medical device industry, where the quality and safety of beverage-based products are critical for patient care. These analyzers play a crucial role in the assessment of parameters such as pH, conductivity, dissolved gases, andspecific chemical components in beverage samples used in medical devices, such as injectable drugs, intravenous solutions, and diagnostic reagents. They ensure the accuracy and reliability of these beverage formulations, verifying their compatibility with medical devices and their efficacy in delivering proper dosages to patients. Beverage quality analyzers also aid in detecting impurities, contaminants, or deviations from required specifications, helping to ensure patient safety and regulatorycompliance. By utilizing beverage quality analyzers, the medical device industry can uphold stringent quality standards, maintain the integrity of beverage-based products, and provide healthcare professionals with reliable and safe tools for diagnosis, treatment, and patient care dynamics, and aquaticlife conditions.

## III. PROJECT STATEMENT

The beverage quality analyzer experiment aims to evaluate the quality of beverage samples by assessing parameters like pH, conductivity, dissolved oxygen, turbidity, and specific ions. By implementing a robust quality control system, the project detects impurities, contaminants, and deviations, ensuring consistent and reliable beverage-based processes. This research contributes toadvancements in industries and applications relying on beverage quality and integrity.

## OBJECTIVES

Designing a Beverage quality analyzer using Arduino Uno and the sensors like PH sensor, Turbidity sensor,

And TDS sensor.

The PH sensor, Turbidity sensor, TDS sensorwill get the PH, Turbidity, TDS values of thebeverage.

Compare the values given by the sensors and the standard values of the beverage used.

Analyze the Collected data by using an App or a Webpage.

## TECHNICAL SPECIFICATIONS

### A. *Arduino nano:*

The Arduino is an electronic device that combines hardware and software to create an electronic Arduino-based project. Arduino is a typeof microcontroller that has additional features suchas [11] a USB connector and GPIO pins.

### B. *pH sensor:*

A pH sensor measures the acidity or alkalinity of a solution by determining its hydrogen ion concentration. It operates by changing the potential difference across a pH-sensitive electrode with pH levels. The sensor, typically a glass or plastic electrode, detects changes in pH levels and generates an electrical signal proportional to the pH value. Theyare essential in various industries for pH measurement, control, and data analysis, ensuring product quality and consistency.

### *C.* Dissolved oxygen sensor:

A dissolved oxygen sensor measures water oxygen concentration, crucial for environmental monitoring, water treatment, aquaculture, and wastewater management. It uses electrochemical principles to assess water quality, ecosystem

### *D.* Tds sensor:

A TDS sensor, also known as a Total Dissolved Solids sensor, is a device used to measure the concentrationof dissolved solids in a solution. TDS refers to the combined content of inorganic salts, minerals, metals, andother substances that are dissolved in water or other beverages.

### *E.* Conductivity sensor:

A conductivity sensor is a device used to measure the electrical conductivity of a solution. Conductivity is a measure of the ability of a solution to conduct an electric current, which is influenced by the presence and concentration of dissolved ions or electrolytes.

### *F.* Temperature sensor:

Temperature sensors measure object or environment temperature, crucial for weather monitoring, HVAC systems, manufacturing processes, and scientific research. They use thermocouples, RTDs, and thermistors for accurate measurement, enabling real-time data and process optimization.

### *Arduino software:*

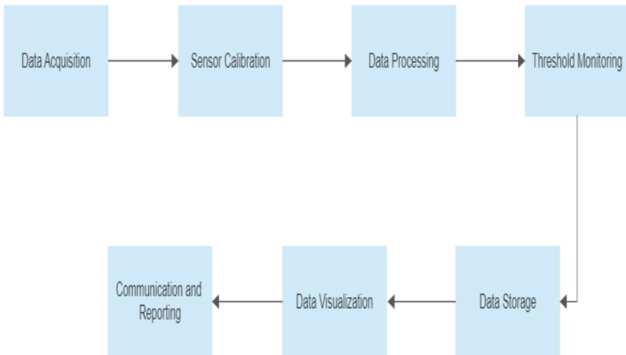
Arduino UNO is one of the greatest programming software for all the above-mentioned operations that complete the total project. The Arduino software is written in the C++ programming language, with some extra unique functions and methods added.

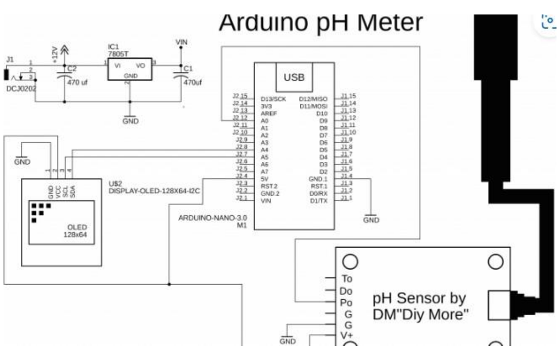
## IV. SYSTEM ARCHITECTURE

The system architecture for a beverage quality analyzer experiment encompasses several key components working together to facilitate precise and reliable analysis of beverage samples. At the core is the beverage quality analyzer itself, comprising specialized sensors,probes, or electrodes designed to measure parameters such as pH, conductivity, dissolved oxygen, turbidity, and more.

A beverage handling system ensures proper collection, storage, and preparation of samples for analysis Instrumentation and control components provide user interfaces and mechanisms for controlling the analyzer's operation, ensuring accurate and repeatable measurements. Data acquisition and processing components capture and process the measured data, whilevisualization and reporting tools present the results in a user-friendly format. Calibration and maintenance components ensure the accuracy and longevity of the analyzer.

Together, this system architecture enables comprehensive assessment of beverage sample quality, supporting informed decision-making, quality control, and advancements in various industries and applications reliant on beverage analysis.

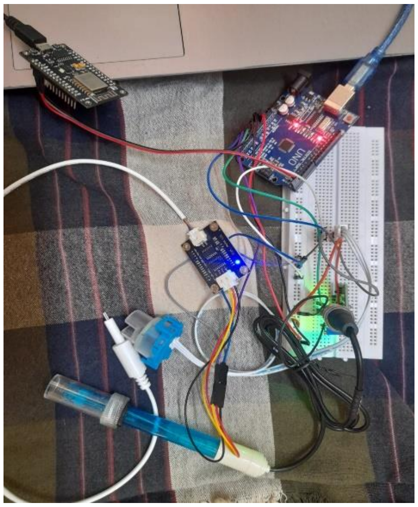


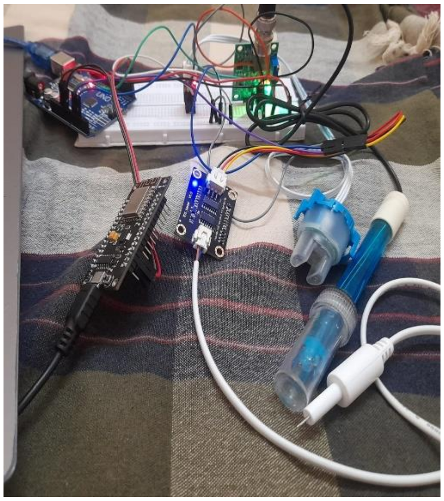



## V. RESULTS AND DISCUSSIONS

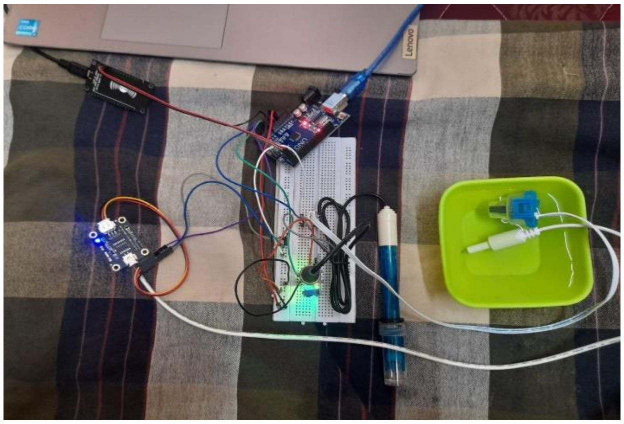
The Arduino UNO,ESP8266 is interfaced with a pH sensor, TDS sensor and Turbidity which is tested individually. The beverage quality analyzer experiment revealed varying performance among tested analyzers, with some demonstrating higher accuracy and precision, closely correlated with reference measurements. Calibration and maintenance play acrucial role in achieving accurate and reliable measurements. Calibration frequency and adherence to maintenance protocols significantly impact analyzer performance. Proper sample handling techniques also play a crucial role in measurement outcomes. Factors contributing to performance variability include sensor technology, calibration procedures, software algorithms, and sample handling. Optimization strategies, such as improving calibration procedures, sensor technology, and software algorithms, are recommended to enhance the accuracy and reliability of beverage quality analyzers. Limitations, such as sample size and potential bias, are acknowledged, and future research should focus on sensor technology advancements, automation, and real-time monitoring to further improve beverage quality analysis.

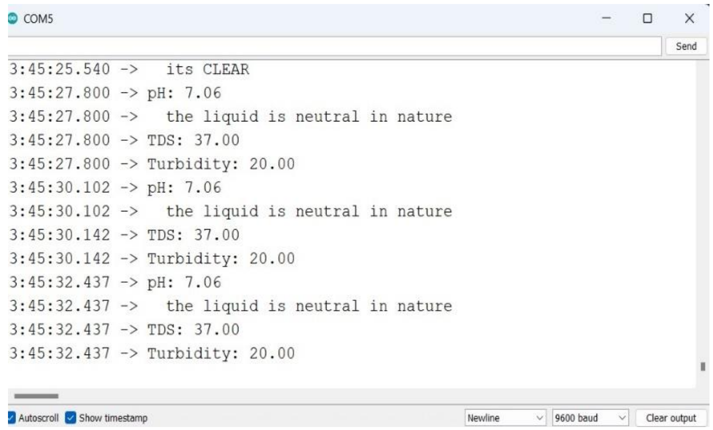
| S.no. | Liquid | pH | Turbitity | TDS |
|---|---|---|---|---|
| 1 | Water | 7.06 | 20 | 37ppm |
| 2 | Sting | 3.41 | 30 | 406ppm |
| 3 | Frooti | 3.56 | 57 | 345ppm |
| 4 | Soap Water | 9.33 | 25 | 1216ppm |





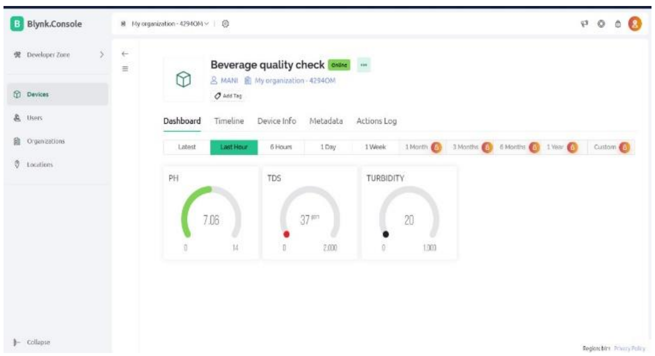
# Water:



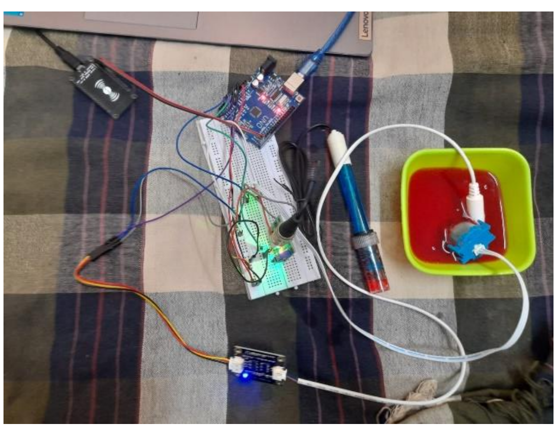


COM5

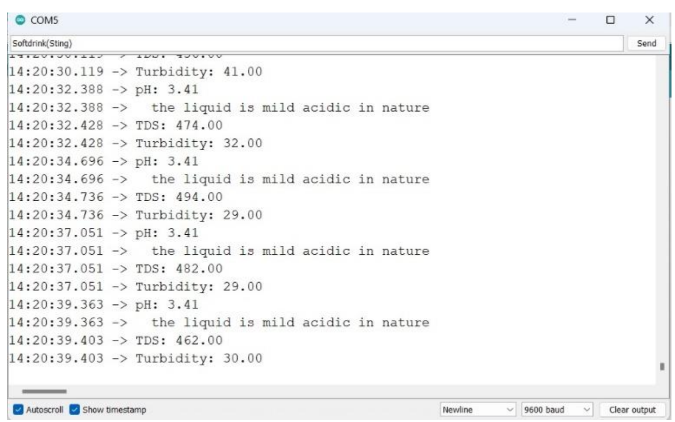
```
3:45:25.540 ->  its CLEAR
3:45:27.800 -> pH: 7.06
3:45:27.800 ->  the liquid is neutral in nature
3:45:27.800 -> TDS: 37.00
3:45:27.800 -> Turbidity: 20.00
3:45:30.102 -> pH: 7.06
3:45:30.102 ->  the liquid is neutral in nature
3:45:30.142 -> TDS: 37.00
3:45:30.142 -> Turbidity: 20.00
3:45:32.437 -> pH: 7.06
3:45:32.437 ->  the liquid is neutral in nature
3:45:32.437 -> TDS: 37.00
3:45:32.437 -> Turbidity: 20.00
```

Autoscroll Show timestamp Newline 9600 baud Clear output




# Sting:

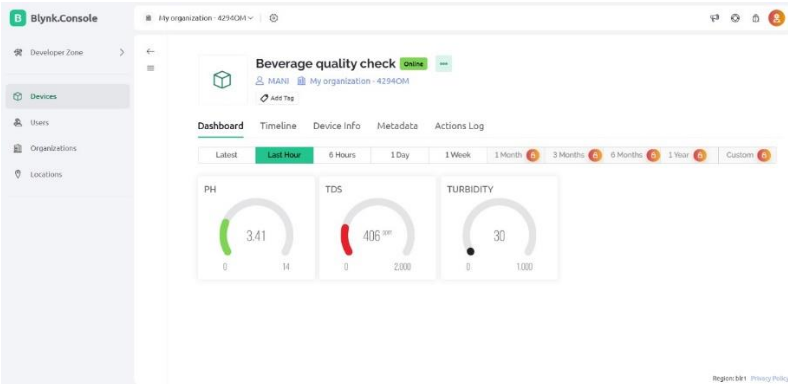




COM5

Softdrink(Sting)

```
14:20:30.119 -> Turbidity: 41.00
14:20:32.388 -> pH: 3.41
14:20:32.388 ->  the liquid is mild acidic in nature
14:20:32.428 -> TDS: 474.00
14:20:32.428 -> Turbidity: 32.00
14:20:34.696 -> pH: 3.41
14:20:34.696 ->  the liquid is mild acidic in nature
14:20:34.736 -> TDS: 494.00
14:20:34.736 -> Turbidity: 29.00
14:20:37.051 -> pH: 3.41
14:20:37.051 ->  the liquid is mild acidic in nature
14:20:37.051 -> TDS: 482.00
14:20:37.051 -> Turbidity: 29.00
14:20:39.363 -> pH: 3.41
14:20:39.363 ->  the liquid is mild acidic in nature
14:20:39.403 -> TDS: 462.00
14:20:39.403 -> Turbidity: 30.00
```

Autoscroll Show timestamp Newline 9600 baud Clear output


Blynk.Console
Developer Zone
Devices
Users
Organizations
Locations
Beverage quality check
Online
MANI
My organization - 4294OM
Add Tag
Dashboard
Timeline
Device Info
Metadata
Actions Log
Latest
Last Hour
6 Hours
1 Day
1 Week
1 Month
3 Months
6 Months
1 Year
Custom
PH
3.41
0
14
TDS
406
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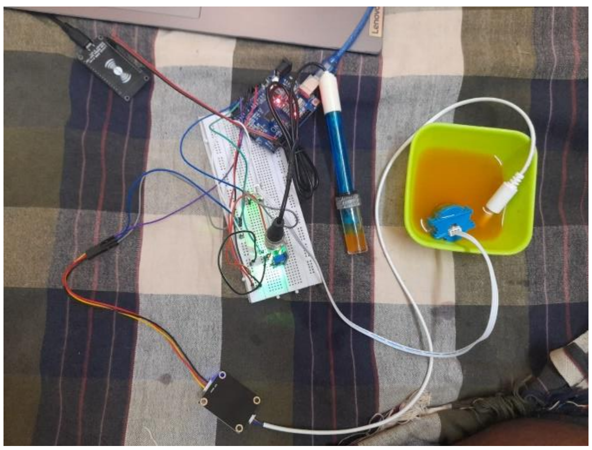
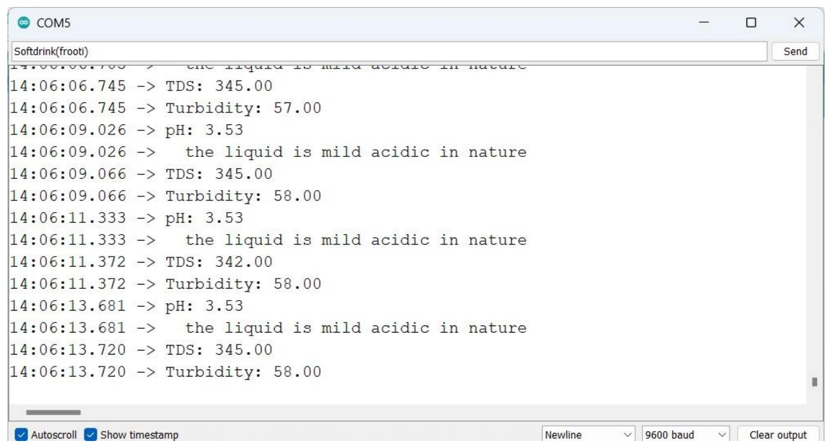
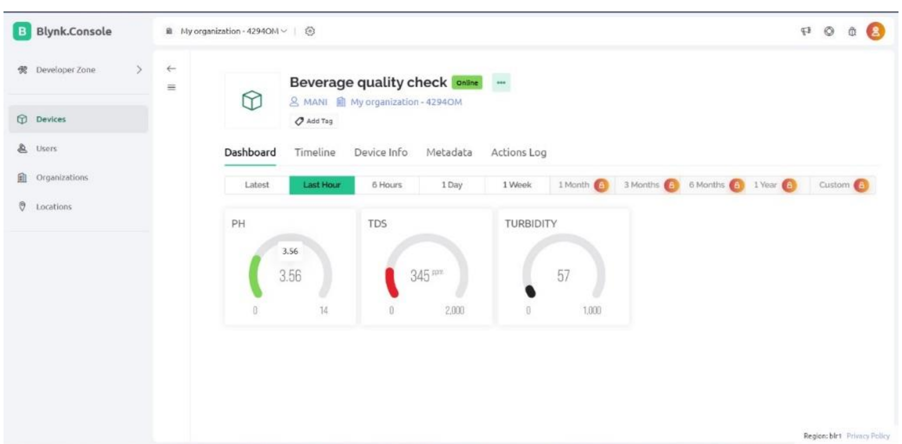
0
1,000
Region: blr1
Privacy Policy

## Frooti:




COM5
Softdrink(frooti)
Send
14:06:06.745 -> TDS: 345.00
14:06:06.745 -> Turbidity: 57.00
14:06:09.026 -> pH: 3.53
14:06:09.026 -> the liquid is mild acidic in nature
14:06:09.066 -> TDS: 345.00
14:06:09.066 -> Turbidity: 58.00
14:06:11.333 -> pH: 3.53
14:06:11.333 -> the liquid is mild acidic in nature
14:06:11.372 -> TDS: 342.00
14:06:11.372 -> Turbidity: 58.00
14:06:13.681 -> pH: 3.53
14:06:13.681 -> the liquid is mild acidic in nature
14:06:13.720 -> TDS: 345.00
14:06:13.720 -> Turbidity: 58.00
Autoscroll
Show timestamp
Newline
9600 baud
Clear output


Blynk.Console
My organization - 4294OM
Developer Zone
Devices
Users
Organizations
Locations
Beverage quality check
Online
MANI
My organization - 4294OM
Add Tag
Dashboard
Timeline
Device Info
Metadata
Actions Log
Latest
Last Hour
6 Hours
1 Day
1 Week
1 Month
3 Months
6 Months
1 Year
Custom
PH
3.56
3.56
0
14
TDS
345
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57
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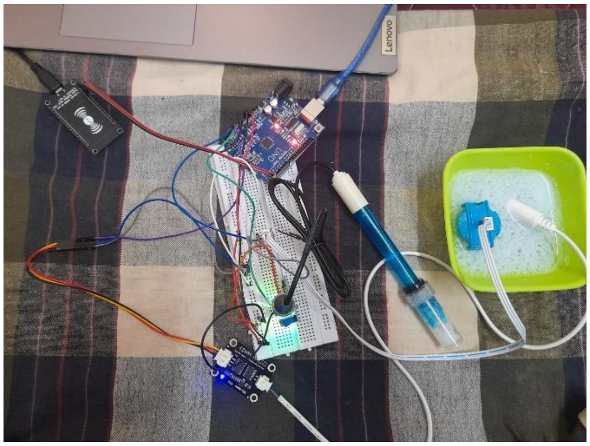
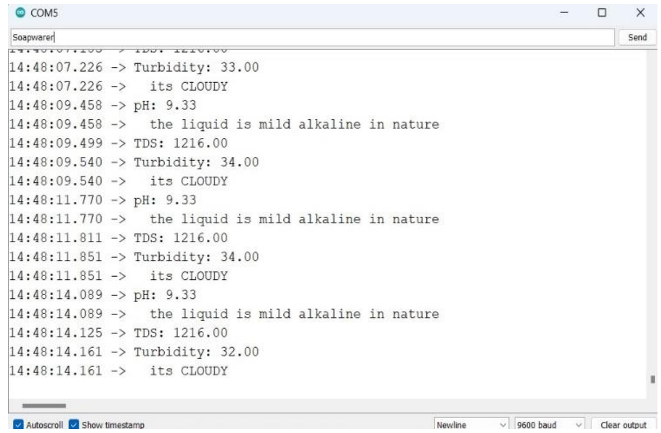
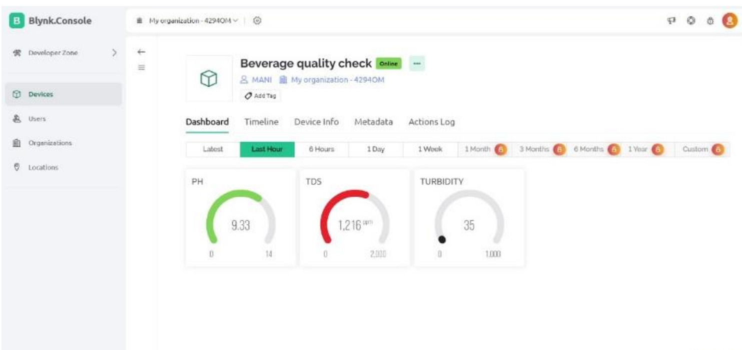
1,000
Region: blr1
Privacy Policy

## Soap Water:




COM5
Soapwarer
Send
14:48:07.226 -> Turbidity: 33.00
14:48:07.226 ->   its CLOUDY
14:48:09.458 -> pH: 9.33
14:48:09.458 ->   the liquid is mild alkaline in nature
14:48:09.499 -> TDS: 1216.00
14:48:09.540 -> Turbidity: 34.00
14:48:09.540 ->   its CLOUDY
14:48:11.770 -> pH: 9.33
14:48:11.770 ->   the liquid is mild alkaline in nature
14:48:11.811 -> TDS: 1216.00
14:48:11.851 -> Turbidity: 34.00
14:48:11.851 ->   its CLOUDY
14:48:14.089 -> pH: 9.33
14:48:14.089 ->   the liquid is mild alkaline in nature
14:48:14.125 -> TDS: 1216.00
14:48:14.161 -> Turbidity: 32.00
14:48:14.161 ->   its CLOUDY
Autoscroll
Show timestamp
Newline
9600 baud
Clear output


Blynk.Console
Beverage quality check
Online
Dashboard
Timeline
Device Info
Metadata
Actions Log
Latest
Last Hour
6 Hours
1 Day
1 Week
PH
9.33
0
14
TDS
1,216
0
2,000
TURBIDITY
35
0
1,000

## VI. ACKNOWLEDGEMENT

We express our wholehearted appreciation and gratitude to Professor " Dr. Sujatha R” professor, Vellore Institute of Technology, Vellore, for her advice, consent, encouragement, and unwavering supervision.

## VII.CONCLUSION & FUTURE SCOPE

To sum up, the experiment to evaluate beverage quality analyzer in real-world applications provided useful information on their performance and efficiency. The results showed that the accuracy and dependability of the beverage quality analyzers vary significantly depending on the calibration, the sensor technology, the sample handling, and the software algorithms. Some analyzers showed high accuracy and good correlation with reference measurements while others showed differences and inconsistencies. Therefore, it is essential for industrial professionals to adhere to proper calibration and maintenance procedures as well as proper sample preparation techniques to improve the performance of the analyzers. It is also recommended to regularly validate against established reference methods to ensure accurate and consistent measurements. The results of this experiment help to improve the efficiency, reliability and compliance of the industrial processes that depend on beverage quality analysis to meet the changingdemands of industrial applications.

The beverage quality analyzers experiment highlights theimportance of selecting the right analyzer for an industrial process, considering factors such as analyzer selection, calibration, maintenance, sample preparation, and validation. Regular calibration accounts for sensor performance changes and ensures accurate measurements. Robust sample preparation techniques, including filtration, degassing, and temperature control, minimize measurement discrepancies and ensure analyzer accuracy.Validation against established reference methods helps identify systematic errors or biases, enabling adjustments or corrections as needed. Overall, a holistic approach to beverage quality analysis is crucial for improved efficiency, compliance, and overall product quality in industrial processes.

Beverage quality analyzers have the potential to revolutionize analysis by miniaturizing and portability, enabling on-site and real-time monitoring in remote or field settings. Advanced sensor technologies, automation, and cloud-based platforms streamline analysis processes, while artificial intelligence and machine learning algorithms enhance data interpretation and predictive modeling. Standardization and interoperability efforts ensure consistency and comparability, while sustainability and eco-friendly materials lead to energy-efficient designs.

For the further development of this system, we can develop an app and add the standard values of the different beverages to the data base and analyze in the app and can include some more sensors to get the more accuracy and can perform different operations.

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s. "Design and Implementation of a LoRa-Based Water Quality Monitoring System"-Praveen
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u. "Online Checking System for Drinking Quality of Drinking Water Vending Machine"-Teerapong Boonlar
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x. "Quality of orange juice drink subjected to a predictive model-based pasteurization process"-Alanzo A. Gabriel.
y. "Open-source mobile water quality testing platform"- Bas Wijinen

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# XI.APPENDIX

**1)**

```
#include <Wire.h>
#include <EEPROM.h>
#include "GravityTDS.h"
float ph;
int turbidity;
#define TdsSensorPin A1
GravityTDS gravityTds;

float temperature = 25,tdsValue = 0;
void setup() {
  // put your setup code here, to run once:
    Serial.begin(9600);
    gravityTds.setPin(TdsSensorPin);
    gravityTds.setAref(5.0);  //reference voltage on ADC, default 5.0V on Arduino UNO
    gravityTds.setAdcRange(1024);  //1024 for 10bit ADC;4096 for 12bit ADC
    gravityTds.begin();  //initialization

}

void loop() {
  // put your main code here, to run repeatedly:
  ph = phRead(A0);

  gravityTds.setTemperature(temperature);  // set the temperature and execute temperature compensation
  gravityTds.update();  //sample and calculate
  tdsValue = gravityTds.getTdsValue();  // then get the value

  turbidity = turbidityRead(A2);

  Serial.print(ph);
  Serial.print(",");
  Serial.print(tdsValue,0);
  Serial.print(",");
  Serial.print(turbidity);
  Serial.println();
  delay(2000);


}
float phRead(int phpin){
  float calibration_value = 21.70-0.7;
  int phval = 0;
  unsigned long int avgval;
  int buffer_arr[10],temp;
  float ph_act;
  for(int i=0;i<10;i++)
 {
 buffer_arr[i]=analogRead(phpin);
 delay(30);
 }
 for(int i=0;i<9;i++)
 {
```

```
 for(int j=i+1;j<10;j++)
 {
 if(buffer_arr[i]>buffer_arr[j])
 {
 temp=buffer_arr[i];
 buffer_arr[i]=buffer_arr[j];
 buffer_arr[j]=temp;
 }
 }
 }
 avgval=0;
 for(int i=2;i<8;i++)
 avgval+=buffer_arr[i];
 float volt=(float)avgval*5.0/1024/6;
  ph_act = -5.70 * volt + calibration_value;
return ph_act;
}
int turbidityRead(int tbpin){
  float sense=analogRead(tbpin);
  int turbidity1 = map(sense, 0,640, 100, 0);
  return turbidity1;
}
```

**2)**

```
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#define BLYNK_PRINT Serial
char auth[] = "4R5ls8shN-c5jllfXpeqwtQ7SHrZtxBm";
char ssid[] = "Galaxy A21sA4F0";
char pass[] = "ljmu7854";
BlynkTimer timer;
float phValue, tdsValue, turbidityValue;

void setup() {
    Serial.begin(9600); // Start serial communication at 9600 bps

    WiFi.begin(ssid, pass);
    while (WiFi.status() != WL_CONNECTED) {
        delay(500);
        Serial.print(".");
    }
    Serial.println("WiFi connected");
    Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
}

void loop() {
    if (Serial.available() > 0) {
        String data = Serial.readStringUntil('\n');
        // Parse the received data
        int commaIndex1 = data.indexOf(',');
        int commaIndex2 = data.indexOf(',', commaIndex1 + 1);

        if (commaIndex1 != -1 && commaIndex2 != -1) {
            // Extract substrings containing each value
            String phString = data.substring(0, commaIndex1);
            String tdsString = data.substring(commaIndex1 + 1, commaIndex2);
            String turbidityString = data.substring(commaIndex2 + 1);
```

```
        // Convert strings to floats
        phValue = phString.toFloat();
        tdsValue = tdsString.toFloat();
        turbidityValue = turbidityString.toFloat();
        Blynk.virtualWrite(V0, phValue);
        Blynk.virtualWrite(V1, tdsValue);
        Blynk.virtualWrite(V2, turbidityValue);

        // Print the received values
        Serial.print("pH: ");
        Serial.println(phValue);
        if(phValue<=3){
          Serial.println("  the liquid is acidic in nature");
        }
        else if(phValue>3 && phValue<6.5){
          Serial.println("  the liquid is mild acidic in nature");
        }
        else if(phValue>6.5 && phValue<7.5){
          Serial.println("  the liquid is neutral in nature");
        }
        else if(phValue>7.5 && phValue<11){
          Serial.println("  the liquid is mild alkaline in nature");
        }
        else if(phValue>11 && phValue<14){
          Serial.println("  the liquid is alkaline in nature");
        }
        Serial.print("TDS: ");
        Serial.println(tdsValue);
        Serial.print("Turbidity: ");
        Serial.println(turbidityValue);
        /*if (turbidityValue < 20) {
          Serial.println("  its CLEAR ");
        }
        if ((turbidityValue > 20) && (turbidityValue < 50)) {
          Serial.println("  its CLOUDY ");
        }
        if (turbidityValue > 50) {
          Serial.println("  its DIRTY ");
        }*/
      }
    }
}
```