MEASURING TURBIDITY OF WATER TO DETERMINE WATER QUALITY USING ARDUINO AND TURBIDITY SENSOR

SUBMITTED BY

J MAHENDRA	**1NH18EC718**
U CHARLES	**1NH18EE059**
K GANESH	**1NH18EC720**
B THARUN	**1NH18EC706**

Guided By

Ms.DALIYA V K

Assistant Professor

Dept. of ECE

New Horizon College of Engineering, Bengaluru

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Water is one of the essential natural resources that has been gifted to mankind. But the rapid development of the society and numerous human activities speeded up the contamination and deteriorated the water resources. For above water quality monitoring is necessary to identify any changes in water quality parameters from time-to-time to make sure its safety in real time.

Water quality monitoring systems need to quickly identify any changes in the quality of water and report the same to the officials for immediate action. The system is designed for continuous onsite sensing and real-time reporting of water quality data where the officials can access the data on the Smart phone/PC through the Internet. Our proposed system employs the use of multiple sensors to measure the parameters, measures the quality of water in real-time for effective action, and is economical, accurate, and required less manpower. The objective of this project is to design an efficient Water turbidity measuring device by using Arduino and turbidity sensor.

CHAPTER 01

INTRODUCTION

CHAPTER 01

INTRODUCTION

Water turbidity is an important measuring unit to determine water quality and describes the degree of water cloudiness.

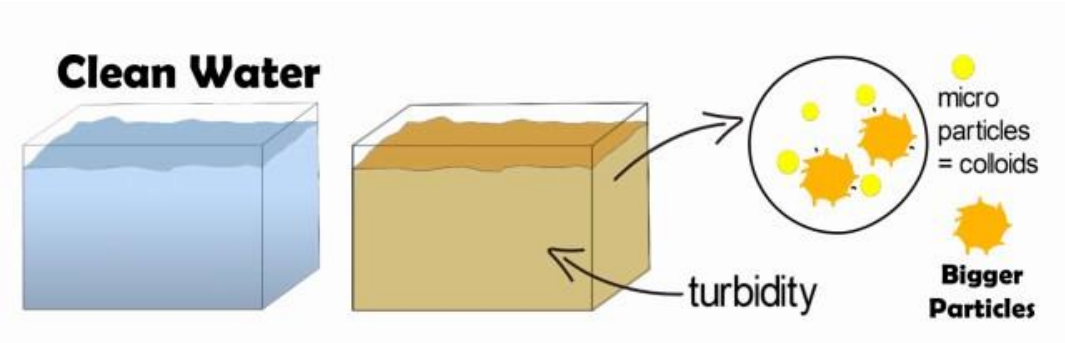


Fig1.1 Turbidity

Turbidity is brought about by an enormous number of little particles that are suspended in water and imperceptible to the natural eye. While greater particles are settling down quickly, little particles – otherwise called colloids – are settling down gradually or not in the slightest degree.

Turbidity in waterways or lakes is frequently brought about by human exercises like development, mining and agribusiness. Tempest water overflow after a precipitation can clean up silt from urbanized regions, enterprises and farmland.

Suspended particles ingest heat from the daylight and lead to water temperature increment. Additionally, a high turbidity disperses the light so photosynthetic action at more profound water levels is limited. Both lessens the measure of oxygen which causes an abatement of aerobe microorganisms and rumbling of oneself cleaning impact of water.

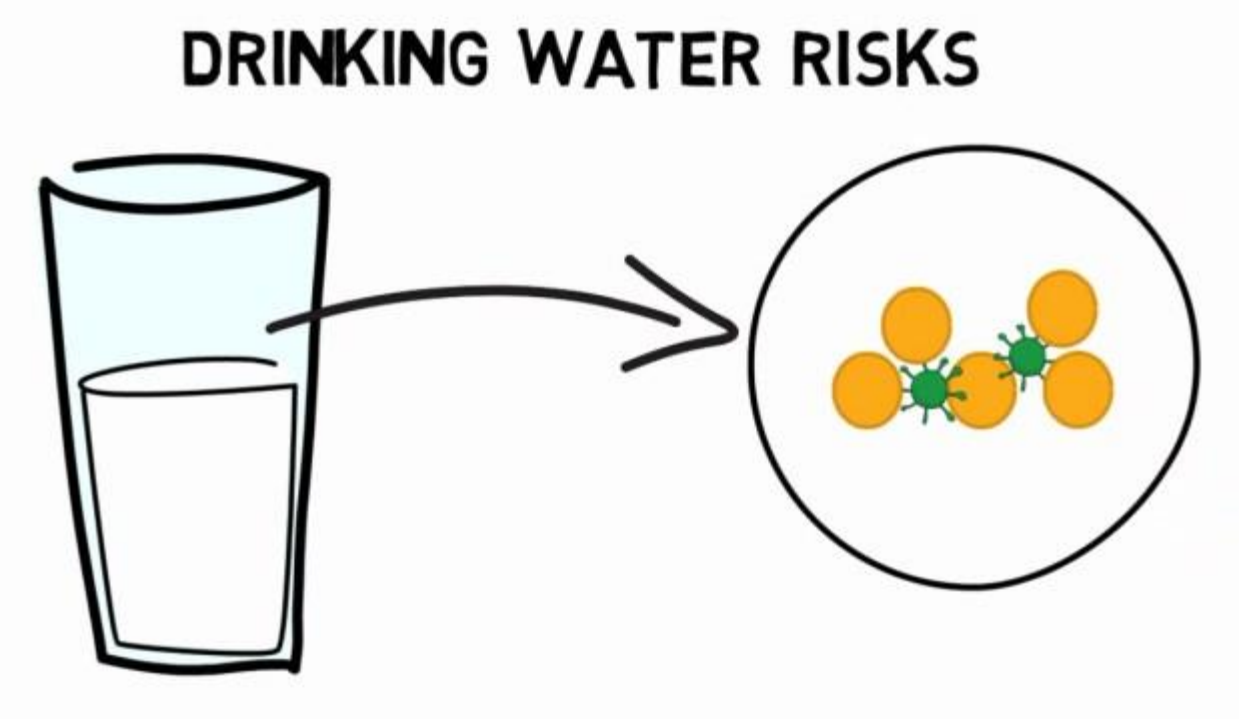


Fig. 1.2 Drinking Water Risks

Turbidity in drinking water and faucet water can cause illnesses in light of the fact that infections or microbes can be appended to suspended solids. Indeed, even disinfectants, for example, chlorine or UV cleansing have just restricted accomplishment at high turbidity levels. This is on the grounds that suspended solids meddle with the disinfectants and go about as shields for infections and microbes.

Faucet water goes through miles of water supply pipes and can get shadiness because of broken or messy lines. The WHO (World Health Organization) distributed that the turbidity of faucet water ought to preferably be under 1 NTU. In the event that you are uncertain about the nature of your faucet water, you can test it with a turbidity meter. This is the thing that, this article is about. We will plan our own Water Turbidity Meter.

In wastewater treatment plants flocculants and coagulants are dosed to water with high turbidity. They modify electrical charges of particles so they cluster together also, structure greater particles. The greater particles are then settled down in sedimentation bowls which are regularly outfitted with lamella clarifiers for improved molecule settling.

CHAPTER 02

LITERATURE REVIEW

CHAPTER 02

LITERATURE REVIEW

Nikhil Kedia named "Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project." Published in 2015 first International Conference on Next Generation Computing Technologies (NGCT-2015) Dehradun, India. This paper features the whole water quality observing strategies, sensors, installed plan, and data dispersal strategy, part of government, network administrator and townspeople in guaranteeing legitimate data scattering. It additionally investigates the Sensor Cloud space. While naturally improving the water, quality isn't doable now, productive utilization of innovation and monetary practices can help improve water quality and mindfulness among people.[1]

Jayti Bhatt, Jignesh Patoliya named "Constant Water Quality Monitoring System".This paper depicts to guarantee the protected stockpile of drinking water the quality should be observed continuously for that reason new methodology IOT (Internet of Things) based water quality checking has been proposed. In this paper, we present the plan of IOT based water quality checking framework that screen the nature of water continuously. This framework comprises a few sensors which measure the water quality boundary, for example, pH, turbidity, conductivity, disintegrated oxygen, temperature. The deliberate qualities from the sensors are prepared by microcontroller and these handled qualities are sent distantly to the center regulator that is raspberry pi utilizing Zigbee convention. At last, sensors information can see on web program application utilizing cloud computing.[2]

Michal Lom, Ondrej Pribyl, Miroslav Svitek named "Industry 4.0 as a Part of Smart Cities". This paper depicts the combination of the Smart City Initiative and the idea of Industry 4.0. The term shrewd city has been a marvel of the most recent years, which is curved particularly since 2008 when the world was hit by the monetary emergency. The fundamental purposes behind the rise of the Smart City Initiative are to make a maintainable model for urban communities and protect personal satisfaction of their residents. The subject of the brilliant city Water Quality Monitoring System Based on IOT 1109 can't be considered uniquely to be a specialized control, however extraordinary financial, philanthropic or legitimate angles should be required too. In the idea of Industry 4.0, the Internet of Things (IoT) will be utilized for the improvement of purported shrewd items. Subcomponents of the item are furnished with their own knowledge. Added insight is utilized both during the assembling of an item just as during resulting taking care of, up to ceaseless observing of the item lifecycle (savvy measures). Other significant parts of the Industry 4.0 are Internet of Services (IoS), which incorporates particularly astute vehicle and coordinations (savvy versatility, keen coordinations), just as Internet of Energy (IoE), which decides how the common assets are utilized in legitimate manner (power, water, oil, and so forth) IoT, IoS, IoP and IoE can be considered as a component that can make an association of the Smart City Initiative and Industry 4.0 – Industry 4.0 can be viewed as a piece of shrewd cities.[3]

Zhanwei Sun, Chi Harold Li,Chatschik Bisdikian,Joel W. Branch and Bo Yang named "QOI-Aware Energy Management in Internet-of-Things Sensory Environments". In this paper an effective energy the executives outline work to

give agreeable QOI experience in IOT tangible conditions is considered. In opposition to past endeavors, it is straightforward and viable to bring down conventions being used, and protecting energy-productivity over the long haul without relinquishing any achieved QOI levels. In particular, the new idea of QOI-mindful "sensor-to-task pertinence" to unequivocally consider the detecting abilities offered by a sensor to the IOT tangible conditions, and QOI necessities needed by an assignment. A tale idea of the "basic covering set" of some random errand in choosing the sensors to support an undertaking after some time. Energy the executives choice is made progressively at runtime, as the ideal for long haul traffic insights under the imperative of the administration delay. At last, a broad contextual analysis dependent on using the sensor organizations to perform water level observing is given to exhibit the thoughts and calculations proposed in this paper, and a recreation is made to show the presentation of the proposed algorithms.[4]

CHAPTER 03

PROPOSED METHODOLOGY

CHAPTER 03

PROPOSED METHODOLOGY

Turbidity is the degree or level of shadiness or cloudiness of a fluid. This occurs because of the presence of enormous quantities of undetectable particles (with the unaided eye) like white smoke noticeable all around. At the point when light goes through fluids, light waves get dissipated Due to the presence of these small particles. The turbidity of a fluid is straightforwardly corresponding to the free suspended particles that is if the quantity of particles expands turbidity will likewise increment.

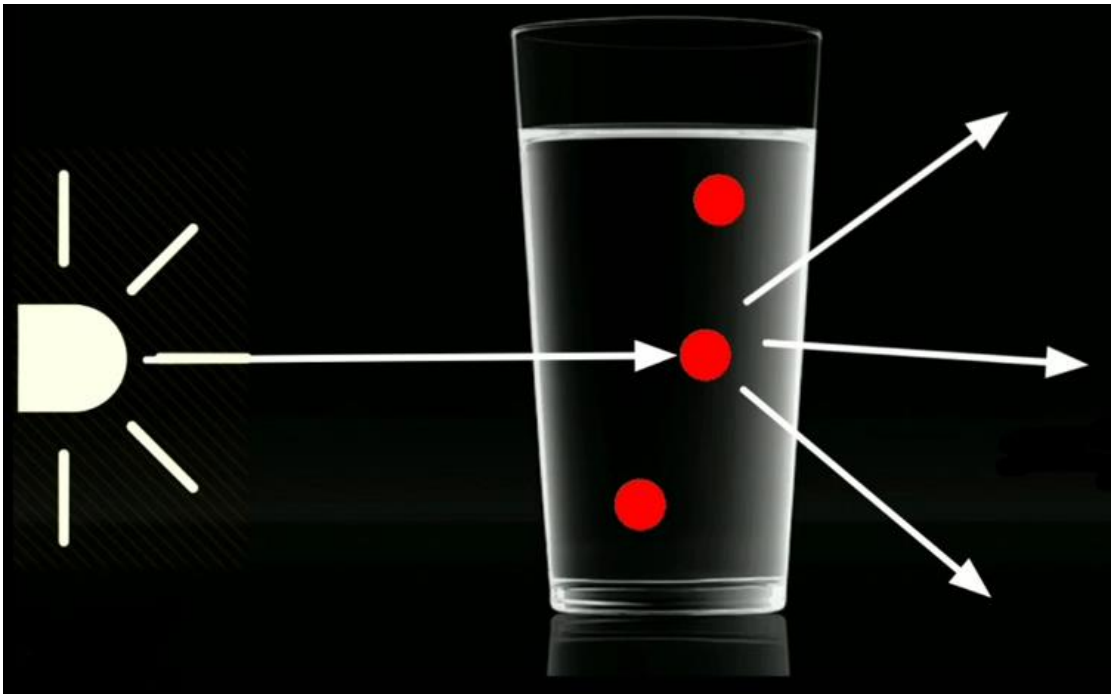


Fig 3.1 Scattering of particles

As I referenced before, turbidity occurs because of the dispersing of light waves, to quantify the turbidity, we should gauge the dissipating of light. Turbidity is generally estimated in nephelometric turbidity units (NTU) or Jackson turbidity units (JTLJ), contingent upon the technique utilized for estimation. The two units are generally equivalent.

Presently we should perceive how a turbidity sensor functions, it has two sections, transmitter and Receiver. The transmitter comprises of a light source commonly a drove and a driver circuit. In the beneficiary end, there is a light locator like a photodiode or a LDR. We place the arrangement in the middle of the transmitter

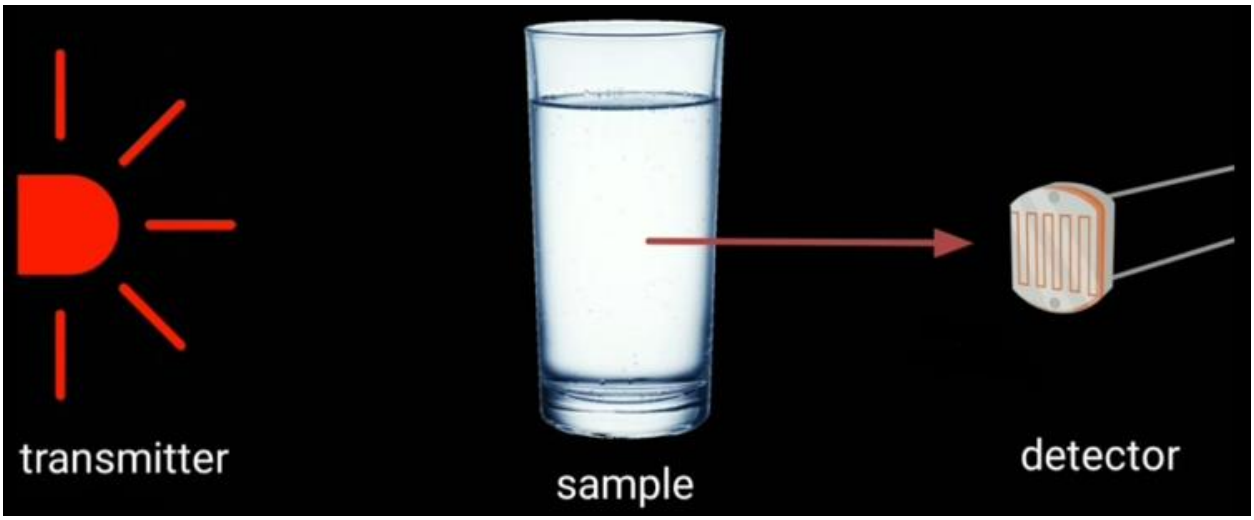


Fig 3.2 Turbidity Measurement

Transmitter just sends the light, that light waves go through the arrangement and the beneficiary gets the light. Ordinarily (without the presence of an answer) the sent light totally gets on the beneficiary side. However, within the sight of a turbid arrangement, the measure of communicated light is exceptionally low. That is on the beneficiary side, we get just a low-power light and this force is contrarily corresponding to turbidity. So we can quantify the turbidity by estimating the light force if the light power is high, the arrangement is less turbid and if the light force is low that implies the arrangement is more turbid

CHAPTER 04

PROJECT DESCRIPTION

CHAPTER 04

PROJECT DESCRIPTION

HARDWARE DESCRIPTION

COMPONENTS REQUIRED

1. Turbidity module
2. Arduino
3. 16*2 LCD
4. Common cathode RGB LED
5. Breadboard
6. Jumper wires

TURBIDITY MODULE

The turbidity sensor used in this project as given below

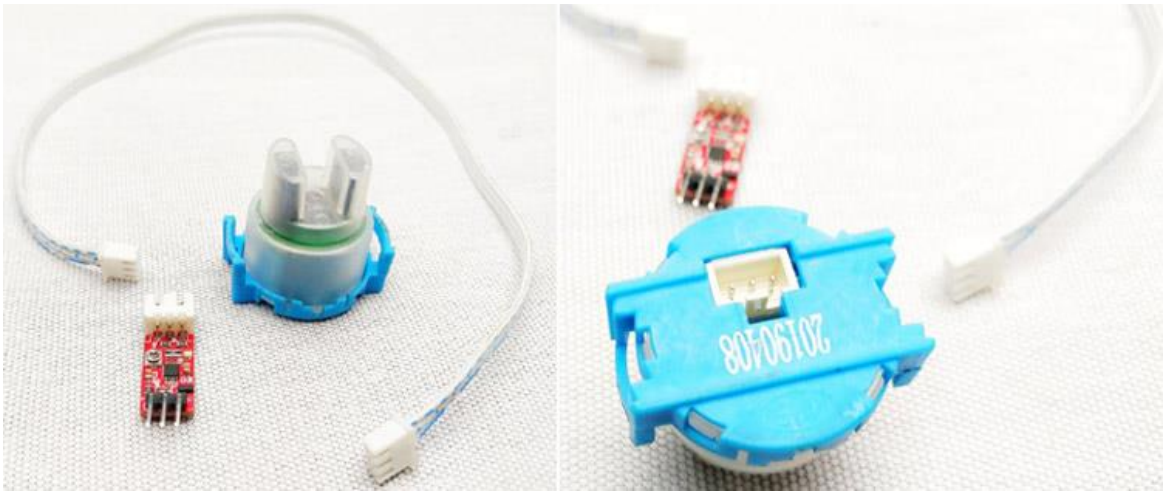


Fig 4.1 Turbidity Sensor

As should be obvious, this turbidity sensor module accompanies 3 sections. A waterproof lead, a driver circuit, and an associating wire. The testing comprises of both the transmitter and collector.

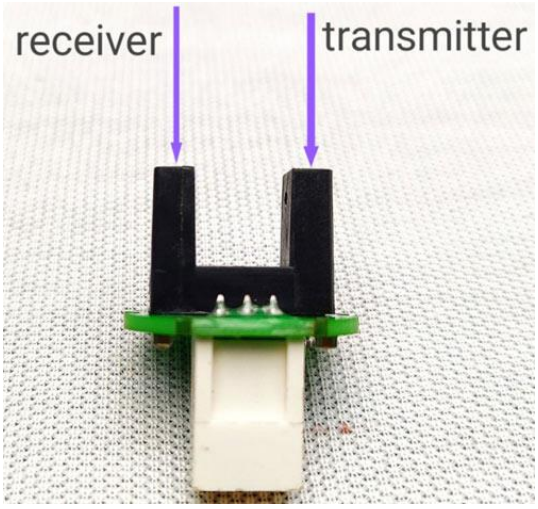


Fig 4.2 Turbidity sensor parts

The above picture shows, this sort of module utilizes an IR diode as a light source and an IR beneficiary as an indicator. Be that as it may, the working guideline is equivalent to previously. The driver part (demonstrated as follows) comprises of an operation amp and a few segments which intensify the distinguished light sign.

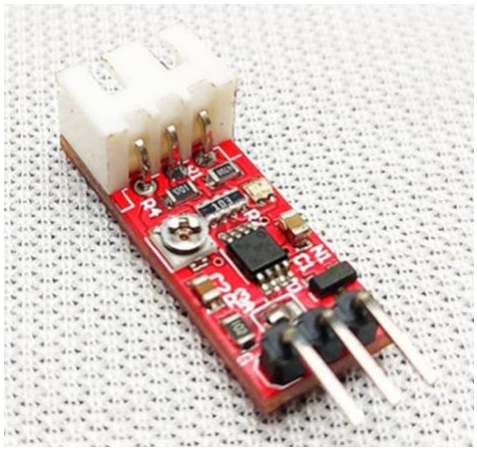


Fig 4.3 Driver part of Turbidity Sensor

The genuine sensor can be associated with this module by utilizing a JST XH connector. It has three pins, VCC, ground, and yield. Vcc associates with the 5v and ground to ground. The yield of this module is a simple worth that is it changes as per the light force.

Key Features of Turbidity Module

- Operating Voltage: 5VDC.

- Current: 30mA (MAX).
- Operating temperature: -30 ° C to 80 ° C.
- Compatible with Arduino, Raspberry Pi, AVR, PIC, etc.

ARDUINO

Fig 4.4 Arduino

Arduino Uno is a microcontroller board dependent on 8-bit ATmega328P microcontroller. Alongside ATmega328P, it comprises different parts, for example, precious stone oscillator, sequential correspondence, voltage controller, and so on to help the microcontroller. Arduino Uno has 14 computerized input/yield pins (out of which 6 can be utilized as PWM yields), 6 simple information sticks, a USB association, A Power barrel jack, an ICSP header and a reset button.

Pin Description

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

Table 4.1 Pin configuration of Arduino

16x2 LCD Module

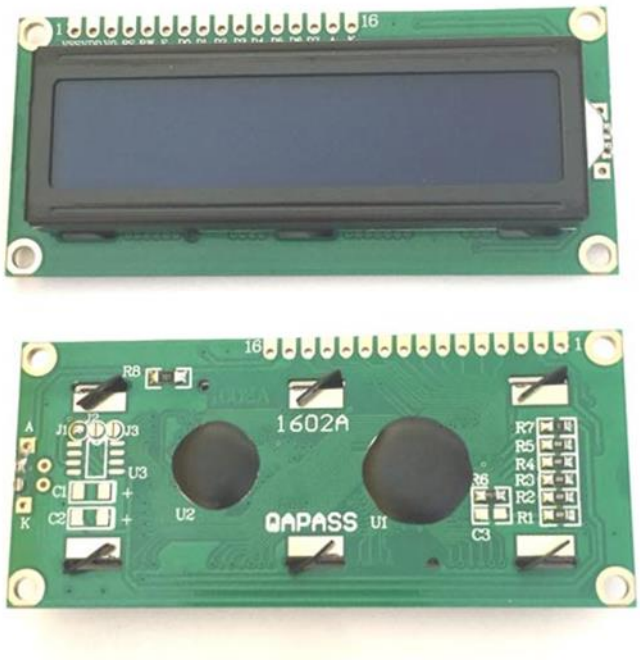


Fig 4.5 16*2 LCD MODULE

Features of 16×2 LCD module

- Operating Voltage is between 4.7V and 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning is able to display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

Pin Configuration

Pin No:	Pin Name:	Description
1	Vss (Ground)	Ground pin connected to system ground
2	Vdd (+5 Volt)	Powers the LCD with +5V (4.7V – 5.3V)
3	VE (Contrast V)	Decides the contrast level of display. Grounded to get maximum contrast.
4	Register Select	Connected to Microcontroller to shift between command/data register
5	Read/Write	Used to read or write data. Normally grounded to write data to LCD
6	Enable	Connected to Microcontroller Pin and toggled between 1 and 0 for data acknowledgement
7	Data Pin 0 TO 7	Data pins 0 to 7 forms a 8-bit data line. They can be connected to Microcontroller to send 8-bit data. These LCD's can also operate on 4-bit mode in such case Data pin 4,5,6 and 7 will be left free.
8	LED Positive	Backlight LED pin positive terminal
9	LED Negative	Backlight LED pin negative terminal

Table 4.2 Pin configuration of 16*2 LCD Module

\RGB LED

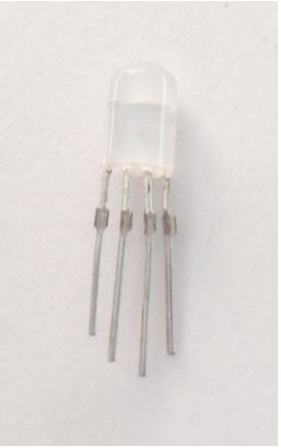


Fig 4.6 RGB LED

Features and Specifications

- Low Thermal Resistance
- No UV rays
- Super High flux Output and High luminance
- Forward Current for Red, Blue and Green color: 20mA
- Forward Voltage
    - Red: 2v (typical)
    - Blue: 3.2(typical)
    - Green: 3.2(typical)
- Luminous Intensity
    - Red: 800 mcd
    - Blue: 4000 mcd
    - Green: 900 mcd
- Wavelength
    - Red: 625 nm
    - Blue: 520 nm
    - Green: 467.5 nm
- Operating Temperature: -25 ℃ to 85 ℃
- Storage Temperature: -30 ℃ to 85 ℃

Pin Configuration

Pin No.	Pin Name	Description
1	R	This terminal used for glowing LED in Red color
2	Gnd	Common Cathode terminal (Ground)
3	G	This terminal used for glowing LED in Green color
4	B	This terminal used for glowing LED in Blue color

Table 4.3 Pin configuration of RGB LED

BREADBOARD

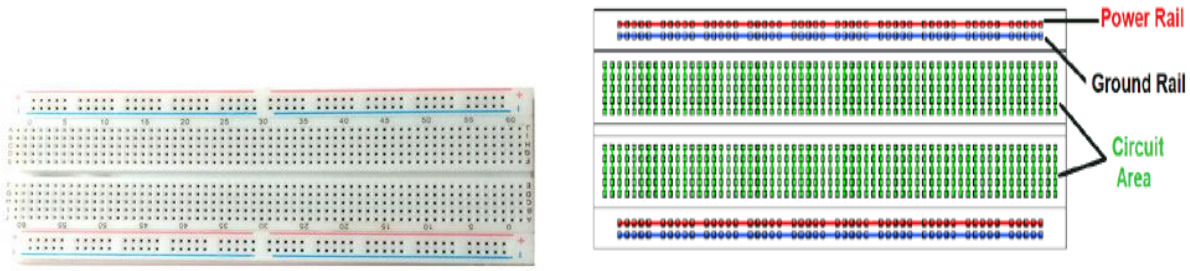


Fig 4.7 BreadBoard

Features and Specifications

- 2 Distribution Strips, 200 tie-points
- 630 tie-points in IC/ circuit areas
- ABS plastic with color legend
- Dimension: 6.5*4.4*0.3 inch

- Hole/Pitch Style: Square wire holes (2.54mm)
- ABS heat Distortion Temperature: 84° C (183° F)
- Rating: 300/3 to 5Amps
- Insulation Resistance: 500MΩ / DC500V
- Withstanding Voltage: 1,000V AC / 1 minute
- Insertion Wire Size: 21 to 26 AWG wire

Jumper Wires

Fig 4.8 Jump Wires

Jumper wires are used for making connections between items on your breadboard and your Arduino's header pins.

CIRCUIT DIAGRAM AND WORKING

Interfacing Turbidity Sensor with Arduino – Circuit Diagram

The total schematic to interface the Turbidity sensor to Arduino is demonstrated as follows, the circuit was planned utilizing EasyEDA.

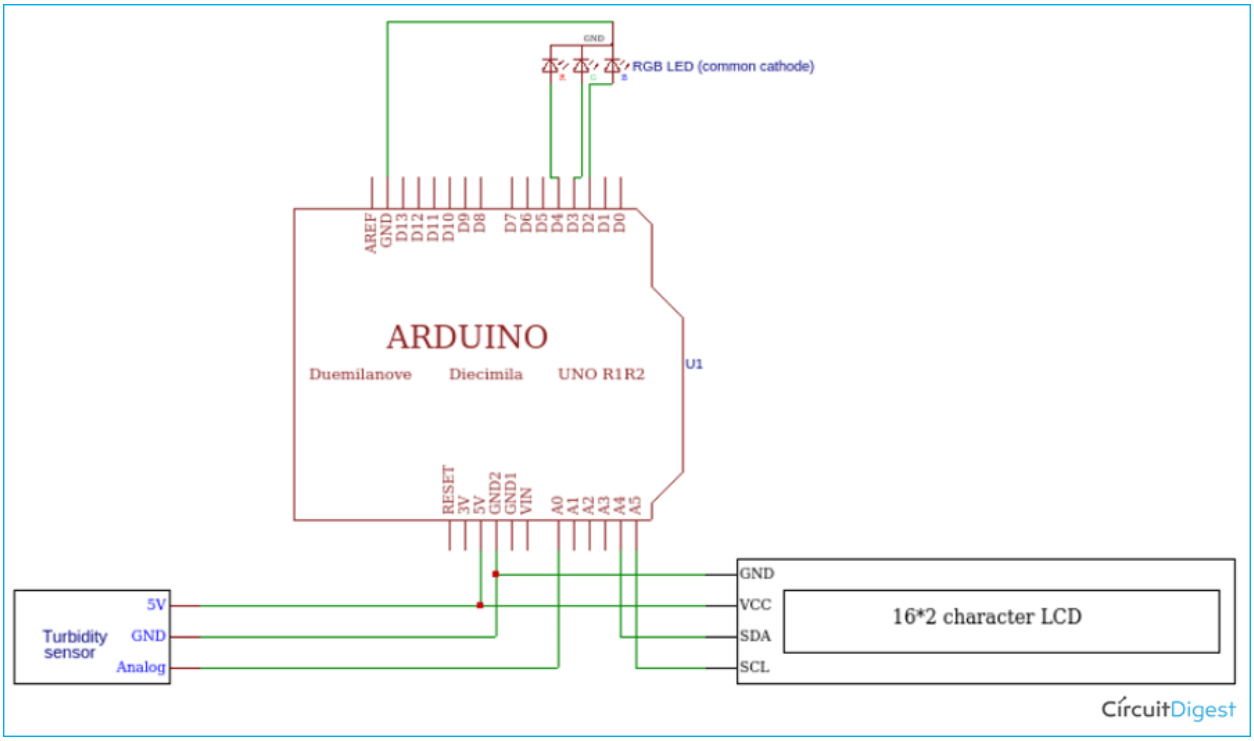


Fig 4.9 Circuit diagram

This is an exceptionally basic circuit outline. The yield of the turbidity sensor is simple so that associated with Arduino's A0 pin, I2C LCD associated with I2C pins of Arduino that is SCL to A5 and SDA to A4. At that point the RGB LED associated with computerized pin D2, D3, and D4. After the associations are done, my equipment arrangement resembles this underneath.

Interface the VCC of the sensor to Arduino 5v, at that point associate ground to ground. The yield pin of the sensor to simple 0 of Arduino. Next, associate VCC

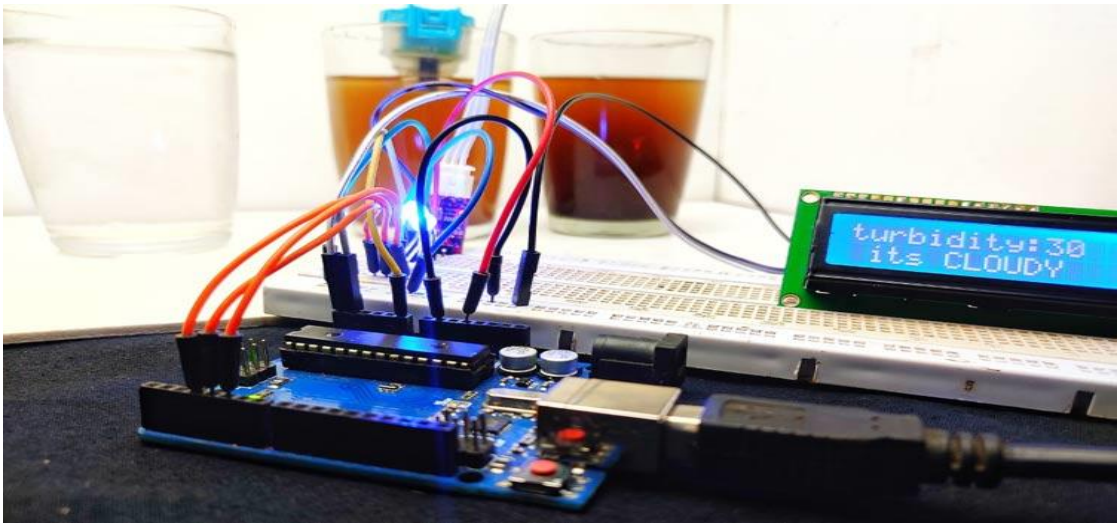
and ground of LCD module to 5v and ground of Arduino. At that point SDA to A4 and SCL to A5, these two pins are the I2C pins of Arduino. at long last associates the ground of RGB LED to the ground of Arduino and interface green to D3, blue to D4, and red to D5.

CHAPTER 05

RESULT AND DISCUSSION

CHAPTER 05

RESULT AND DISCUSSION



If the turbidity is less than 20 then the water is clear. If the turbidity is between 20 and50 then the water is cloudy. If the turbidity is greater than 50 then the water is dirty.

This turbidity meter displays the percentage of turbidity and it might not be an accurate industrial value, but still it can be used to compare the water quality of two water.

Turbidity measurements are frequently implemented for the monitoring of heterogeneous chemical, physical, or biotechnological processes. ... However, very strong influences of the ambient conditions on the measurements of the turbidity probe have been observed, limiting its applicability.

CHAPTER 06

CONCLUSION AND FUTURE SCOPE

CHAPTER 06

CONCLUSION AND FUTURE SCOPE

The constant water quality observing framework for ongoing applications which is effective and minimal effort, has been tried after the execution. This can help in forestalling sicknesses caused because of dirtied water and the presence of metals. It has a positive importance to fortify ecological assurance. It additionally has a positive importance to improve natural execution all through the network. Three boundaries are checked in this framework which is pH, temperature and dissolved oxygen. The sicknesses that are caused because of the presence of metals and toxins in the water can be ensured by this framework. The undertaking of observing should be possible by utilizing less prepared people. The establishment of the framework should be possible effectively when it is close to the objective zone. To guarantee the convey ability of the gadget, a self-mode, little size Arduino microcontroller is utilized. The aftereffects of the test for all occasions have been effective. We infer that all the goals of the proposed framework have been accomplished. To test more boundaries of the water quality for certain applications, different sensors can be remembered for the framework. The framework has great adaptability. Exclusively by supplanting the comparing sensors and changing the significant programming programs, this framework can be utilized to screen other water quality boundaries. The activity is straightforward. The framework can be extended to screen hydrologic, air contamination, mechanical and horticultural creation, etc. Labor is decreased. The quantity of boundaries to be detected can be expanded by the expansion of different sensors to quantify dissolved oxygen (DO), chemical oxygen demand (COD), biochemical

oxygen demand (BOD), ammonia nitrogen, nitrate, nitrite, phosphate. The framework can be additionally redesigned utilizing remote sensor organizations.

In future we use IOT idea in this undertaking

- Detecting the more parameters for most secure purpose
- Increase the parameters by addition of multiple sensors

REFERENCES

[1] Emmanuel ani, "Water Quality Monitoring and Notification System," May 4, 2016.[Online].Available: https://www.hackster.io/eani/water-quality-monitoring-and-notification- system-f85d23

[2] Hao Jei chan, "Water Quality Monitoring System," March 9, 2017. [Online]. Available: https://www.hackster.io/chanhj/water-quality-monitoring-system-ddcb43

[3] svsembedded. "IOT Based Industrial Water Quality Monitoring System using Temperature, Ph and Turbidity Sensors." Online video clip. YouTube. YouTube, May 31, 2017. Web. 18 July 2018.

[4] V. D. of Sustainability and Environment, "Monitoring and reporting - results," April 2012. [Online]. Available: http://www.water.vic.gov.au/monitoring/river-health/isc/results.

[5] Jefferson Paredes and Alysson Alvaran, "Water Quality Monitoring using MK R1000 and ARTIK Cloud," September 21, 2016. [Online].Available: https://www.hackster.io/animo/water-quality- monitoring-using-mkr1000-and-artik-cloud-840fea

[6] Vincent Wong, "ARTIK + MKR1000 + DHT11 + MQTT," September 20, 20 16.[Online]. Available: https://www.hackster.io/wesee/artik-mkr1000-dht11-mqtt-cae0d7

[7] Ruan Yue and Tang Ying," A Novel Water Quality Monitoring System Based on Solar Power Supply & Wireless Sensor Network ".

[8] B. O'Flyrm, R. Martinez, J. Cleary, C. Slater, F. Regan, D. Diamond, and H. Murphy, "Smartcoast: A wireless sensor network for water quality monitoring," I n Proceedings of 32nd IEEE Conference on Local Computer Networks (LCN 20 07). IEEE, 2007, pp. 815–816.

[9] M. A. Nasirudin, U. N. Za'bah, and O. Sidek, "Fresh water real-time monitoring system based on wireless sensor network and gsm," In Proceedings of IEEE Conference on Open Systems (ICOS). IEEE, 2011, pp. 354–357.

[10] S.Wadekar, V.Vakare, R.Prajapati, Shivam Yadav and V.Yadav," Smart Wat er Management using IOT,"In Proceedings of 5th International conference on Wir eless Networks and embedded System (WECON),2016.

[11] World Health Organization. (7 February 2018). Drinking Water [online]. Av aiable:http://www.who.int/news-room/fact-sheets/detail/drinking-water

[12] Arvind Sanjeev,"Make an Arduino flow rate sensor to measure water flow f or a variety of applications," [online]. Available: https://maker.pro/arduino/tutorial /how-to-interface-arduino- with-flow-rate-sensor-to-measure-liquid/

[13] Geetha, S. & Gouthami, S. Smart Water (2016) 2: 1. https://doi.org/10.1186/ s40713-017- 0005-y

[14] codebender_cc,"How to Use Water Flow Sensor - Arduino Tutorial,".[onlin e].available: http://www.instructables.com/id/How-to-Use-Water-Flow-Sensor-Arduino-Tutorial/