

SMART SEWERAGE MONITORING SYSTEM USING LORA

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering degree in Electronics and Communication Engineering

by

NALLURI NIRISHA (Reg. No. 37130275)
CHIMAKURTHY NAGA SINDHU (Reg. No. 37130085)



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

APRIL - 2021



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with "A" grade by NAAC

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119

www.sathyabama.ac.in



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **NALLURI NIRISHA** (Reg. No.37130275) and **CHIMAKURTHY NAGA SINDHU** (Reg. No.37130085) who carried out the project entitled "**SMART SEWERAGE MONITORING SYSTEM USING LORA**" under my supervision from.

Internal Guide

Dr .P.KAVIPRIYA, M.E, Ph.D.,

Head of the Department

Dr. T. RAVI, M.E., Ph.D.,

Submitted for Viva voce Examination held on _____

Internal Examiner

External Examiner

DECLARATION

We **NALLURI NIRISHA (Reg. No.37130275)** and **CHIMAKURTHY NAGA SINDHU (Reg. No.37130085)** hereby declare that the Project Report entitled “**SMART SEWERAGE MONITORING SYSTEM USING LORA**” done by us under the guidance of **Dr. P.KAVIPRIYA, M.E., Ph.D.**, is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in **ELECTRONICS AND COMMUNICATION ENGINEERING**.

DATE:

PLACE:

SIGNATURE OF THE CANDIDATE

- 1.**
- 2.**

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. N.M. NANDITHA, M.E., Ph.D.**, Dean, School of Electrical and Electronics and **Dr. T. RAVI, M.E., Ph.D.**, Head of the Department, Dept. of Electronics and Communication Engineering for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Dr. P.KAVIPRIYA, M.E., Ph.D.**, for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Electronics and Communication Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

The serious and unattended problem due to the overflow and clogging of the drainage for a long time can escort to the hurdles of musty odor and originate the water borne diseases. If the lid of drainage system is open during rainy season, then it also causes the penalty of death. The solution for the above issues is designed here through the sensor network. Thereby, the integrated sewage modules are proposed here to attend the issues at several points of the drainage area. The unmanned lifting solution for the clogging wastage or garbage is designed here to protect sewer from penalty of death. The anomalous status of drainage system is also intimated to the concern department to consider for further necessary action. The proposed work is experimented and proved by transferring the integrated anomalous status of drainage system through the LoRa technology. There is a need for an efficient system design for monitoring a gully pot which is capable of providing required information about sewage block, prior to the occurrence. A Wireless Sensor Network (WSN) is used to observe and detect the sewage block and the detected information will be transmitted to the authority through a LORA.

TABLE OF CONTENTS

CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	i
	LIST OF FIGURES	v
	LIST OF TABLES	vi
1	INTRODUCTION	1
2	LITERATURE SURVEY	2
	2.1 IoT Device For Sewage Gas Monitoring And Alert System	2
	2.2 Sewage-Source Heat Pump Based On Web Access - Remote Monitoring System	2
	2.3 Scada Design System With Ph Effluent Monitoring On Sewage Treatment Plant In Mawar's College At Uitm Shah Alam Using Tbox	3
	2.4 Detecting And Reporting Sewage Fire Through Deployment Of Three Dimensional Multi-Sink Wireless Sensor Network	3
	2.5 Automatic Monitoring And Control System Of Industrial Sewage Treatment	3
	2.6 Web-Based Real Time Underground Drainage Or Sewage Monitoring System Using Wireless Sensor Networks	4
	2.7 Monitoring And Evaluation On Water Quality Of Hun River Based On Landsat Satellite Data	4
	2.8 Toxic Environment Monitoring Using Sensors Based On Arduino	4
	2.9. Design Of Sewage Treatment Monitoring System Based On Internet Of ThingS	5

	2.10 Automatic Solid Waste Extraction And Segregation For Sewage Drain Management	5
3	AIM AND SCOPE	6
	3.1 Existing System	6
	3.1.1 Drawbacks of Existing System	7
	3.2 Proposed System	7
	3.2.1 Block diagram of Proposed System	8
	3.2.2 Arduino	9
	3.2.2.1 Digital	9
	3.2.2.2 Analog	10
	3.2.2.3 Output Signals	10
	3.2.2.4 Input Signals	11
	3.2.3 LORA	13
	3.2.4 Gas Sensor	14
	3.2.5 PH Sensor	14
	3.2.5.1 Principle Of PH Meter	15
	3.2.5.2 PH Measurement	15
	3.2.5.3 Working of PH Sensor	16
	3.2.6 Flow Sensor	17
	3.2.6.1 Working Principle of flow Sensor	17
	3.2.7 Nodemcu	18
	3.2.7.1 GPIO Pins	19
	3.2.7.2 ESP-12E Module	20
	3.2.7.3 Power Requirement	21
	3.2.7.4 Peripherals and I/O	22
	3.2.7.5 Multiplexed I/O's	22
	3.2.7.6 On-Board switches& Led Indicator	23
	3.2.7.7 Serial Communication	24
	3.2.7.8 Esp8266 Nodemcu Pinout	24
4	ARDUINO SOFTWARE	27
	4.1 Writing Sketches	27

	4.2 File	29
	4.3 Edit	29
	4.4 Sketch	30
	4.5 Tools	30
	4.6 Help	31
	4.7 Sketchbook	31
	4.8 Tabs, multiple files, and compilation	31
	4.9 Uploading	31
	4.10 Libraries	32
	4.11 Third-Party Hardware	32
	4.12 Serial Monitor	32
	4.13 Preferences	32
	4.14 Language Support	32
	4.15 Boards	33
5	RESULT	34
6	CONCLUSION	42
	REFERENCES	43

LIST OF FIGURES

FIGURE NO	TITLE	PAGE NO
3.1	Block diagram of existing system	6
3.2.1	Block diagram of proposed system	8
3.2.2	Arduino UNO	8
3.2.2.4	PIN Configuration of Arduino UNO	11
3.2.3	LoRa Module	14
3.2.4	MQ-2 Gas Sensor	14
3.2.5	pH Sensor	15
3.2.5.2	pH Scale	15
3.2.5.3	Working of pH sensor	16
3.2.6.1	Flow Sensor	18
3.2.7	ESP8266-01 Module	19
3.2.7.1	NodeMcu GPIO's	19
3.2.7.2	ESP-12E module	21
3.2.7.3	NodeMcu power pins	22
3.2.7.4	NodeMcu Multiplexed I/O's	23
3.2.7.5	NodeMcu Switches and Indicators	23
3.2.7.6	NodeMcu CP2102 USB-to-UART Bridge Controller	24
3.2.7.7	NodeMcu Pin Configuration	24
5.1	Transmitter	34
5.2	Geo tagging photo of Transmitter	35
5.3	Values at Transmitter side	35
5.4	Receiver	36
5.5	Geo tagging photo of Receiver	37
5.6	Connecting to wifi	37
5.7	Alert message of Gas sensor	38
5.8	Alert message of pH sensor	38
5.9	Alert message of Level sensor	39
5.10	Alert message of Flow sensor	39
5.11	Alert message over mobile	40
5.12	Alert Messages on 16×2 LCD display	41

LIST OF TABLES

TABLE NO	TITLE	PAGE NO
3.2.5.5	pH value of solutions	17
3.2.7.1	NodeMCU GPIOs	20

CHAPTER 1

INTRODUCTION

Due to high population and increment of wastage per individual, there are frequent sewage flooding and pollution incidents which result in large social consequences for communities and individuals alike. Thus a system is required to monitor on a 24*7 basis to rectify the situation. To develop a smart city, wireless based network is useful to collect the data and control water pollution and manage the water distribution system properly. Enhances sanitation of the city as well as avoids unnecessary congestion on roads. The problem with traditional sewage treatment plants is that they have an effective crop management system. It involves the operator always checking whether everything is in order at the factory. The operator usually does not have one or more tools to help him determine whether the factory is in good condition or whether the factory has problems. He must do it by experience. For example, if the vehicle transporting sewage from one storage tank to another is a dry operation, the operator can only do this after a certain period of time, that is, if the storage tank to be replaced has not changed. By the time he saw this, the car might have broken down, or the car had been damaged a lot.

CHAPTER 2

LITERATURE REVIEW

2.1 IOT DEVICE FOR SEWAGE GAS MONITORING AND ALERT SYSTEM

Gas sensors are used for detecting the poisonous gases in sewage. The sensors like MQ4 and MQ7 emits values which are produced from sewage to control kit. Thus the output is transferred to the cloud through GSM. Arduino and GSM modules are the main components used. Arduino is used to read the values collected from the gas sensors like MQ4(methane sensor) and MQ7(carbon monoxide sensor) from wastes and sewages. Things speak IoT platform is used to represent the values graphically and user can monitor the values that is stored from the sensors. Finally, when the values exceed the threshold value, the status or a warning is sent to the user's mobile phone through the GSM module. It's main aim is to avoid accidents that occurred to the labours when they are working at the sewage tanks and to rescue them from harmful gases that are emitting from sewage.

2.2 SEWAGE-SOURCE HEAT PUMP BASED ON WEB ACCESS - REMOTE MONITORING SYSTEM

Paper cautioning paper dependent on site access technique With the presentation of Internet innovation and versatile innovation, the M2M framework has started to acquire genuine force for advancement. There have been numerous ventures that utilization this coordinated framework in numerous vertical arrangements and attempt to incorporate one arrangement stage into different incorporated frameworks. The most recent advancement is the utilization of HTTP REST engineering as a correspondence stage. This task tackled the initial step of dispatching Open MTC as a M2M and IoT correspondence stage. The sensors included are concentrated carbon monoxide gas, temperature and mugginess, joined with Zigbee and Arduino microcontrollers, to frame two gadget segments associated with Open MTC GSCL (or DA proposed by the ETSI M2M standard).

2.3 SCADA DESIGN SYSTEM WITH PH EFFLUENT MONITORING ON SEWAGE TREATMENT PLANT IN MAWAR'S COLLEGE AT UITM SHAH ALAM USING TBOX

The shrewd woodland depends on the idea of the Internet of Things (IoT), which depicts the piece of the backwoods that utilizes distant sensors to gather natural condition information. One of the principle objectives of Smart Forest is to cause fierce blazes in its outset. Be that as it may, the vital innovation for such checking generally requires perplexing and costly sensors and organization framework, and requires focal handling ability to dissect information from a large number of sensors. The motivation behind this undertaking is to utilize the idea of portable center points (M-Hubs) to propose an answer for edge processing.

2.4 DETECTING AND REPORTING SEWAGE FIRE THROUGH DEPLOYMENT OF THREE DIMENSIONAL MULTI-SINK WIRELESS SENSOR NETWORK

Timberland fires are regular in winter everywhere on the world. A right timberland fire recognition technique is expected to screen the spread of fire and lessen the misfortune rate. In this article, we propose a practical fire identification and announcing measure utilizing a three-power multi-beneficiary remote sensor organization. This framework can be utilized when the occasion is running, time is running, or in the suggested blended mode. The consequences of the proposed system were contrasted and three significant degrees forms of the absolute most mainstream tactile pathways.

2.5 AUTOMATIC MONITORING AND CONTROL SYSTEM OF INDUSTRIAL SEWAGE TREATMENT

Because of force limits, individuals need to save assets or use assets. Because of the great contamination of water assets and the expanding utilization of accessible water, ecological disinfection has become a significant issue that should be concentrated today. In this article, you will investigate the modern wastewater treatment measure, utilizing PLC, MCGS programming and PROFIBUS to perform squander the board checking and control.

2.6 WEB-BASED REAL TIME UNDERGROUND DRAINAGE OR SEWAGE MONITORING SYSTEM USING WIRELESS SENSOR NETWORKS

Waste is the framework or cycle by which water, sewage or different fluids are depleted from a spot and to keep up the appropriate capacity of seepage, its condition ought to be observed consistently. In any case, physically it is hard to screen all zone where a human can't reach. This impacts the blockage of underground lines and floods of water cause the medical condition. To alleviate every one of these issues here we are created and executed the framework utilizing remote sensor organization. It comprising of little gadgets used to gather information. These detecting gadgets are called hub.

2.7 MONITORING AND EVALUATION ON WATER QUALITY OF HUN RIVER BASED ON LANDSAT SATELLITE DATA

As the most plentiful inland stream of water asset in Liaoning region, Hun River bears the cost of mechanical and rural creation and homegrown water task in focal city gathering of Liaoning territory. As of late, many sewage depleting exits in various sizes are continually releasing along Hun River. Natural checking report can find that markers of smelling salts nitrogen and COD are high. Alkali nitrogen and COD focus are one of significant pointers to quantify water climate and it is important to screen, assess and study the dirtied stream quality.

2.8 TOXIC ENVIRONMENT MONITORING USING SENSORS BASED ON ARDUINO

These days, individuals are self important by risky climate. Harmful contamination undermined in water, soil, and air is hurtful or noxious. It incorporates processing plant made squanders like poisonous hefty metals from mining or synthetic compounds from industrial facilities, and furthermore sewage and particulates from power plants. Defilement comes in numerous structures, and it contaminates individuals in an unexpected way, once in a while in manners that may not be quickly noticeable. This framework is made for individuals wellbeing

applications. This paper expected to observing poisonous gases in harmful natural conditions for wellbeing applications dependent on Wi-Fi.

2.9 DESIGN OF SEWAGE TREATMENT MONITORING SYSTEM BASED ON INTERNET OF THINGS

The Internet of Things (IOT) depicts the interconnection of gadgets and individuals through the customary web and informal organizations for different everyday applications like climate checking, medical care frameworks, brilliant urban areas, water system field, and keen way of life. IOT is the new transformation of the present web world which screens live gushing of the whole world's status like temperature, dampness, rainstorm, seismic tremor, floods and so forth that can amaze a caution to human existence. This paper proposes a minimal effort climate observing framework which recovers the climate state of any area from the cloud information base administration framework and shows the yield on an OLED show.

2.10 AUTOMATIC SOLID WASTE EXTRACTION AND SEGREGATION FOR SEWAGE DRAIN MANAGEMENT

The expansion popular for water and its scarcity have guided us to water recovery draws near. There have been horde inadequacies in sewage burn through guideline for quite a while which carried low proficiency to reject profluent water treatment. The presence of strong squanders in the sewage decays the proportion of waste water that is headed to squander water treatment plant.

CHAPTER 3

AIM & SCOPE

3.1 EXISTING SYSTEM

In most developing and underdeveloped countries, manual scavenging or visual inspection is carried out. Many water organizations have utilized telemetry frameworks to introduce some manual hardware. Multiple sensors are placed and used to measure and collect data in numerous locations. This data is then used by various software and application programs that allow the data to be turned into useful and accessible information.

In the existing system they used gas sensors for detecting the poisonous gases in sewage. The sensors like MQ4 and MQ7 emits values which are produced from sewage to control kit. Thus the output is transferred to the cloud through GSM. Arduino and GSM modules are the main components used. Arduino is used to read the values collected from the gas sensors like MQ4(methane sensor) and MQ7(carbon monoxide sensor) from wastes and sewages. Things speak IoT platform is used to represent the values graphically and user can monitor the values that is stored from the sensors. Finally, when the values exceed the threshold value, the status or a warning is sent to the user's mobile phone through the GSM module. It's main aim is to avoid accidents that occurred to the labours when they are working at the sewerage pipelines and to protect them from harmful gases that are emitting from sewage.

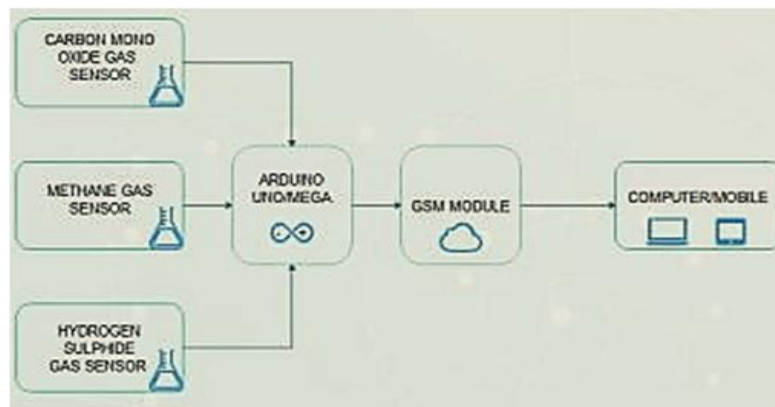


Fig:3.1 : Block diagram of existing system

3.1.1 DRAWBACKS OF THE EXISTING SYSTEM

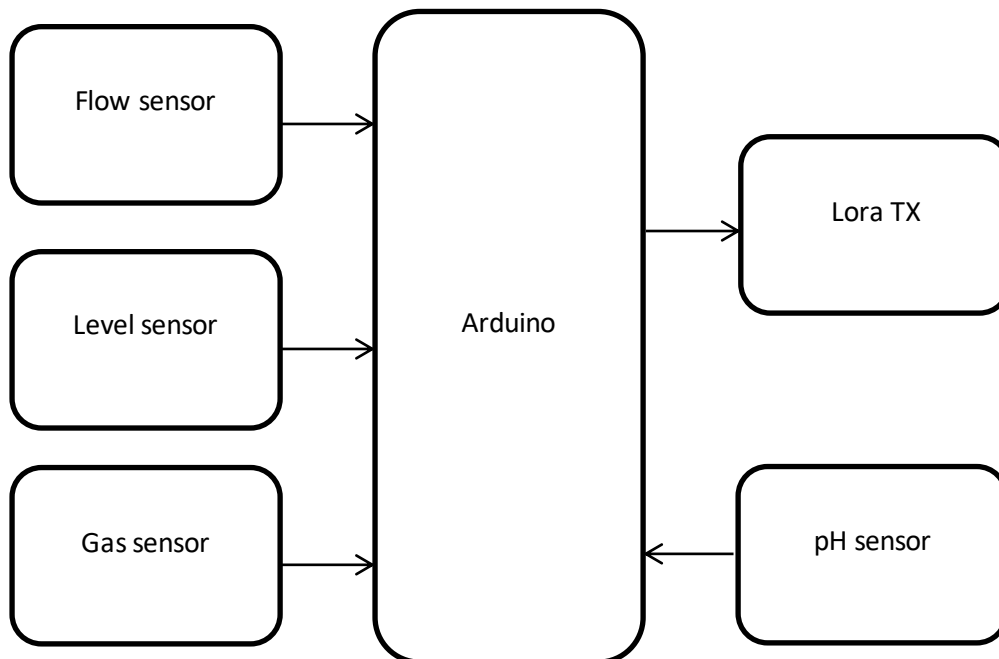
- Manual scavenging is a dehumanizing act.
- Visual inspection proves to be inefficient and costly.
- The operating costs of telemetry systems are still high because these systems require a wider connection to PSTN (Public Switched Telephone Network), and because of the cost, it is not possible to deploy power sources in large areas.

3.2 PROPOSED SYSTEM

A realistic implementation of a low-cost wireless WSN that monitors the gullies water level in a populated area using LORA contact and acoustic sensor technologies. The monitoring system reduces road congestion caused by sewage backups, enhances public health, and improves society sanitation.

3.2.1 BLOCK DIAGRAM OF PROPOSED SYSTEM

TRANSMITTER



RECEIVER

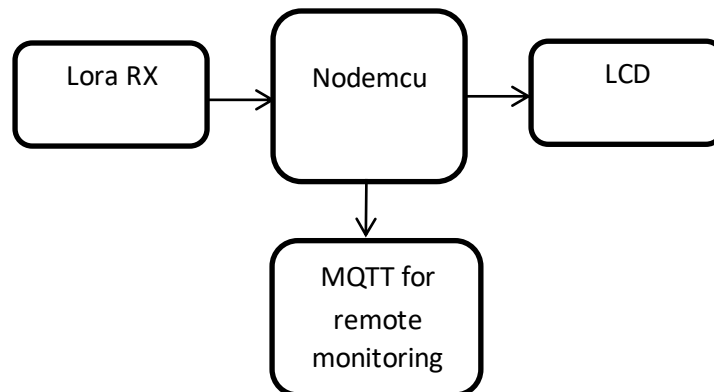


Fig:3.2.1 : Block diagram of proposed system

Microcontroller is used to interface the sensor like flow sensor, level sensor, gas sensor, PH sensor. These sensor were interfaced with microcontroller Arduino that will consider as a transmitter side enable with Lora Transmitter and the receiver side consist of a microcontroller named as NodeMcu which is going to be receiver side controller enable with Lora Receiver. and we have a LCD display to the parameters. the Lora Receiver is used here to receive the corresponding data from the Lora transmitter with help of a microcontroller

3.2.2 ARDUINO

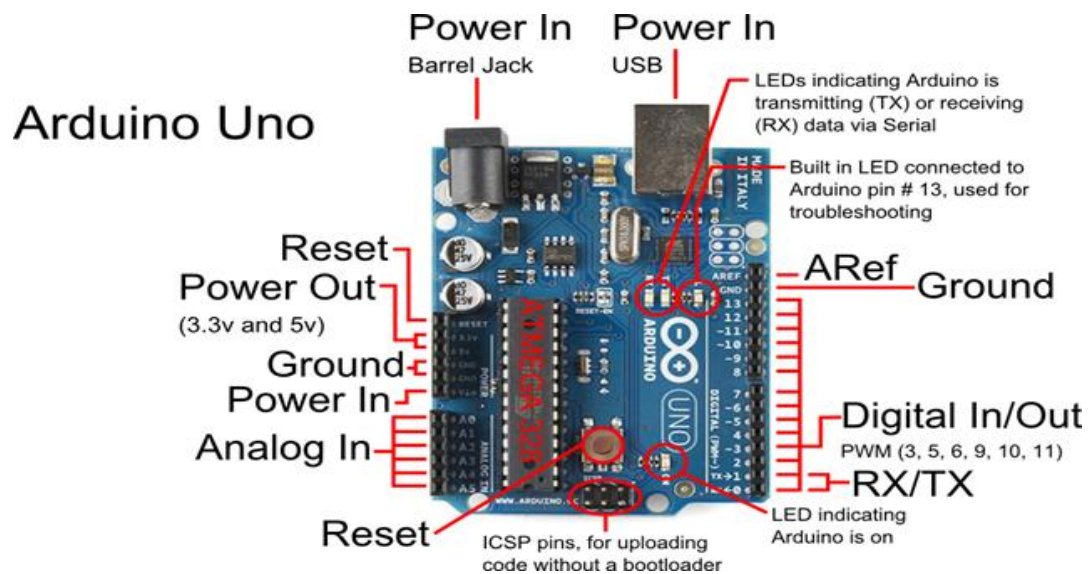


Fig:3.2.2 : Arduino Uno

The voltage divider is used to set voltage for inputs given like increasing and decreasing. This is 5V on an Arduino. The optimal value for V_{out} should be value of the second resistor is now the only variable left. Once you've figured out R_2 , you'll be able to figure out the rest of the components of your voltage divider.

The only difference between powering an Analog Reference and reading a sensor is that you must compute the Voltage reference Out worth you choose to help analogue testimonial.

The Arduino can handle a wide range of electrical signals, both analogue and digital. Understanding the differences between these two types of signals, as well as how to exploit the information they contain, is critical.

3.2.2.1 DIGITAL

An electrical signal that may be the presence or absence of current, high and low voltages, or short pulses at a specific frequency and is transmitted as binary code.

To get Digital messages the Arduino utilizes Digital pins # 0 - # 13. You may likewise arrangement your Analog In pins to go about as Digital pins. To set up Analog In pins as Digital pins utilize the order:

```
pinMode(pinNumber, value);
```

```
digitalRead(pinNumber);
```

```
digitalWrite(pinNumber, esteem);
```

In addition the Arduino is able to yield a Digital sign that coverts to Analog sign, which is called Pulse Width Modulation. To yield a PWM signal utilize the order:

```
analogWrite(pinNumber, esteem);
```

3.2.2.2 ANALOG

We watch and listen is a ceaseless transferring data to nearby facilitates the climate condition that we experience are rarely 100% warmth or 100% cold, the rapidly change with our scope of worthy climate conditions.

In the realm of aurdino, analog signal can be either higher or low, it lies only in between these these two states, this implies that the analog voltage is esteemed in between 0 volts to 5 volts. Contingent upon the voltage of the Analog sign when contrasted with the Analog Reference signal the Arduino at that point doles out a mathematical worth to the sign somewhere close to 0 (0%) and 1023 (100%). The advanced arrangement of the Arduino would then be able to utilize this number in estimations and representations.

To get Analog Input the Arduino utilizes Analog pins # 0 - # 5. These are utilized for Analog Input & no arrangement fundamental, peruse them utilize order:

```
analogRead(pinNumber);
```

```
analogWrite(pinNumber, esteem);
```

3.2.2.3 OUTPUT SIGNALS

In Arduion there normal Digital Output and Pulse Width Modulation Output (PWM).Yield is just conceivable with Digital pins # 0 - # 13. The Digital pins are preset as Output pins, so except if the pin was utilized as an Input in a similar sketch, there is no motivation to utilize the pinMode order to set the pin as an Output. Should a circumstance emerge where it is important to reset a Digital pin to Output from Input utilize the order:

```
pinMode(pinNumber, OUTPUT);
```

```
digitalWrite(pinNumber, esteem);
```

```
analogWrite(pinNumber, value);
```

3.2.2.4 INPUT SIGNALS

The Analog Input pins are # 0 - # 5. These signs begin from simple sensors and interface gadgets. These simple sensors and gadgets use voltage levels to convey their data rather than a basic yes (HIGH) or no (LOW). Therefore you can't utilize a computerized pin as an info pin for these gadgets. Simple Input pins are utilized distinctly for getting Analog signs. It is simply conceivable to peruse the Analog Input sticks so there is no order vital in the arrangement() capacity to set up these pins for input. To peruse the Analog Input pins utilize the order:

```
analogRead(pinNumber);
```

Advanced Input can enter your Arduino through any of the Digital Pins # 0 - # 13. Computerized Input signals are either HIGH (On, 5V) or LOW (Off, 0V).

```
pinMode(pinNumber, INPUT);
```

It mainly deals with the inner side of the input signals

```
digitalRead(pinNumber);
```

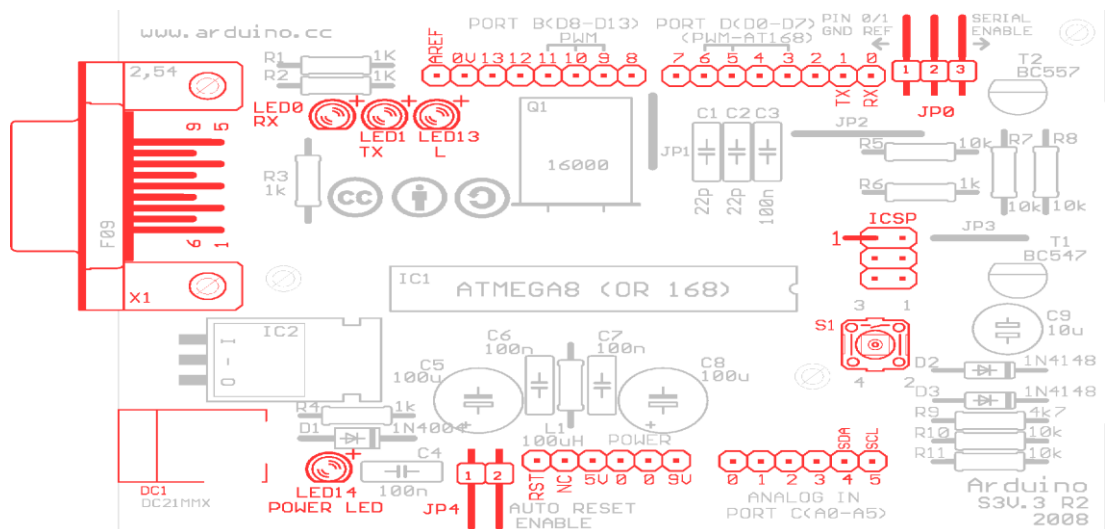


Fig:3.2.2.4 : Pin Configuration of Arduino Uno

X1:

DE-9 chronic connector

Used to associate PC (or different gadgets) utilizing RS-232 norm.

DC1:

2.1 mm. power jack

Used to associate outside power source. Focus +ve.

ICSP:

2x3 pin header Used to program Atmega with bootloader. The number 1 on the two sides of the board demonstrates link pin1 position. Used to transfer portraits on Atmega ICs without bootloader.

JP0:

3 pins jumper when in position 2-3, this jumper empowers sequential association (through X1 connector) to/from PC/gadgets. When in position 1-2, it impairs sequential correspondence, and empowers outer draw down resistors on pin0 (RX) and pin1 (TX).

JP4:

2 pins jumper when in position 1-2, this jumper empowers auto reset highlight, valuable while transferring a sketch to Arduino, resetting Atmega naturally.

S1:

Material catch This catch resets Atmega, to restart transferred sketch or to get ready Arduino to get a sketch through chronic connector (when auto reset isn't dynamic).

LEDS:

Characteristic leds POWER drove Turns on when Arduino is controlled through DC1, +9v. pin or +5v. pin.

RST pin:

Makes Atmega reset when associated with GND. Helpful for Shield Boards, or to associate outside reset.

NC pin:

This pin isn't associated in Arduino S3v3. Arduino Diecimila has a 3.3 volts pin similarly situated.

+9v. pin

It is another external power supply.

+5v pin:

Can be utilized as Vout , providing +5 volts. +5v pin

0v pin:

Alongside analog reference pin. At the point when Arduino DC1 is controlled, 0v. pin supplies 0 volts reference (GND) for +5v. pin and +9v. pin.

GND pin:

See 0v pin (GND).

AREF pin:

It is nothing but a analog reference pin.

3.2.3 LORA

Since LoRa characterizes the lower actual layer, the upper systems administration layers were deficient. LoRaWAN is one of a few conventions that were created to characterize the upper layers of the organization. LoRaWAN is a cloud-based medium access control (MAC) layer convention yet acts principally as an organization layer convention for overseeing correspondence between LPWAN entryways and end-hub gadgets as a directing convention, kept up by the LoRa Alliance.

LoRa WAN characterizes the correspondence convention and framework engineering for the organization, while the LoRa actual layer empowers the long-range correspondence connect. LoRa WAN is additionally answerable for dealing with the correspondence frequencies, information rate, and force for all devices. Devices in the organization are nonconcurrent and communicate when they have information accessible to send. Information sent by an end-hub gadget is gotten by various entryways, which forward the information parcels to an incorporated organization worker. Information is then sent to application workers. The innovation shows high dependability for the moderate burden, notwithstanding, it has some exhibition issues identified with sending affirmations.



Fig:3.2.3 : Lora Module

3.2.4 GAS SENSOR

A gas sensor is a very important chemical sensor. A chemical sensor consists of a transducer and an active layer, which is used to convert chemical data into another electronic signal, such as frequency change, current change, or power change. Since the amount of gas in the atmosphere is different, it can have a significant impact on human health, atmospheric pollution or industrial or medical processes.

Basically, the traditional detection method that makes a gas alarm system alert people if there is a dangerous or toxic gas leak is not very reliable because it requires finding the right amount of time for the target gas to be detected.



Fig:3.2.4 : MQ-2 gas sensor

3.2.5 PH SENSOR

pH sensor is used to measure the pH value of liquid. It differs between 0 to 14. It is the logarithmic estimation of moles of hydrogen particles per liter of arrangement. If the pH value is in between 0 to 6 are acidic, if pH value is 8 to 14 are basic in nature. If pH is 7 then it is neutral.



Fig:3.2.5 : pH sensor

3.2.5.1 PRINCIPLE OF PH METER OR PH SENSOR

pH meter fundamentally chips away at the way that interface of two fluids creates a electric potential which can be estimated. All in all when a fluid inside an walled in area made of glass is put inside an answer other than that fluid, there exists an electrochemical potential between the two fluids.

3.2.5.2 PH MEASUREMENT

A vital estimation in numerous fluid substance measures (mechanical, drug, fabricating, food creation, and so on) is that of pH: the estimation of hydrogen particle focus in a fluid arrangement. An answer with a low pH esteem is called an "corrosive," while one with a high pH is known as a "harsh." The basic pH scale extends from 0 (in number corrosive) to 14 (in number scathing), with 7 in the center addressing unadulterated water (unbiased):

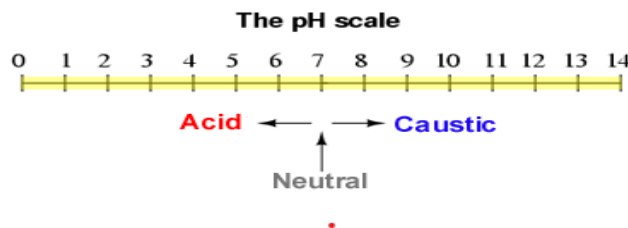


Fig:3.2.5.2 : pH scale

3.2.5.3 WORKING OF PH SENSOR

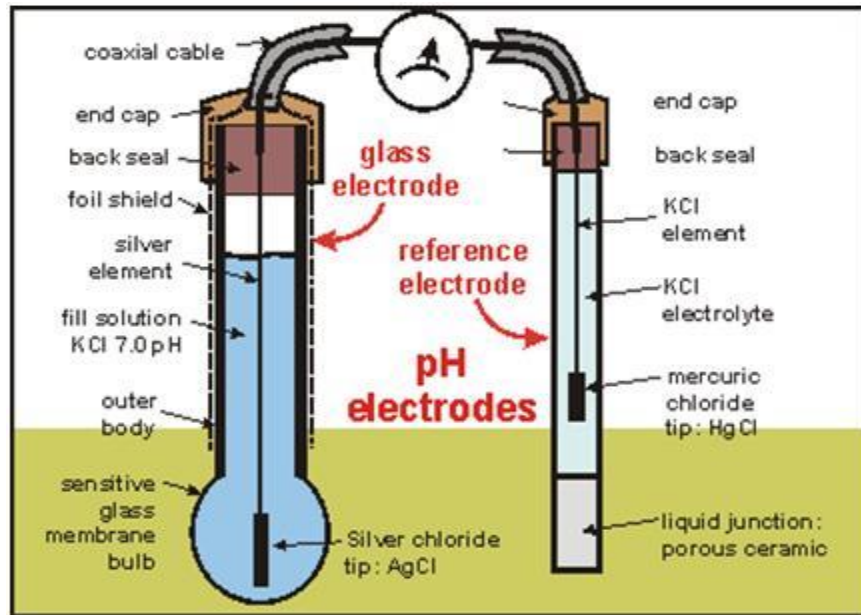


Fig:3.2.5.3 : Working of pH sensor

Place the terminal inside the container to measure pH. The glass bulb welded toward the finish of the estimation terminal comprises of lithium particles doped to it which makes it go about as a particle particular obstruction and permits the hydrogen particles from the obscure answer for move through the boundary and interfaces with the glass, building up an electrochemical possible identified with the hydrogen particle fixation. The reference terminal potential doesn't changes with the hydrogen particle fixation and gives a steady potential against which the estimating cathode is thought about. It comprises of an impartial arrangement which is permitted to trade particles with the obscure arrangement through a permeable separator, along these lines framing low opposition association with complete the entire circuit. The potential contrast between the two anodes gives an immediate estimation of the hydrogen particle fixation or pH of the framework and is first preamplifier to fortify it and afterward given to the voltmeter.

$$U = E_{pH} - E_{ref}$$

E_{pH} – Voltage potential of measurement electrode

Eref – Voltage potential of reference electrode

The pH is calculated based on the Nernst equation which states that change in total potential for every change in pH is

$$U = -kT\text{pH}$$

k- boltzman's constant, T- temperature

Table 3.2.5.5 : pH value of solutions

Solution	pH Value
Battery Acid	0-1
Stomach Acid	2
Coca Cola	2.53
Gatorade (Lemon Lime)	2.93
Black Coffee	5
"Pure" Water	7
Toothpaste	8-9
Household Bleach	12-13

3.2.6 FLOW SENSOR

A flow sensor that measures the flow rate of along pipes or tubes. Flow sensors are able to detect leaks, blockages etc.

3.2.6.1 WORKING PRINCIPLE OF FLOW SENSOR

- Water flow sensor consists of a plastic valve from which water can pass. A water rotor alongside a Hall Effect sensor is available to sense and measure the water stream.

- When water courses through the valve it pivots the rotor. By this, the change can be seen in the speed of the engine. This change is determined as yield as a heartbeat signal by the Hall Effect sensor. Along these lines, the pace of stream of water can be estimated.



Fig:3.2.6.1 : Flow sensor

3.2.7 NODE MCU

The ESP8266 is an exceptionally easy to use and minimal effort gadget to give web availability to your tasks. It is used to transfer it to the web making Internet of Things. It can likewise get information from web utilizing API's consequently your undertaking could get to any data that is accessible in the web, accordingly making it more brilliant. Another energizing component of this module is that it very well may be modified utilizing the Arduino IDE which makes it much more easy to understand. Anyway this adaptation of the module has just 2 GPIO pins (you can hack it to utilize upto 4) so you need to utilize it alongside another microcontroller like Arduino, else you can look onto the more independent ESP-12 or ESP-32 renditions. So in the event that you are searching for a module to begin with IOT or to give web availability to your venture then this module is the correct decision for you.

HOW TO USE THE ESP8266 MODULE

There are such countless strategies and IDEs accessible to with ESP modules, yet the most normally utilized on is the Arduino IDE. So let us examine just about that further beneath. The ESP8266 module works with 3.3V just, anything over 3.7V would murder the module subsequently be alerts with your circuits. The most ideal

approach to program an ESP-01 is by utilizing the FTDI board that upholds 3.3V programming.

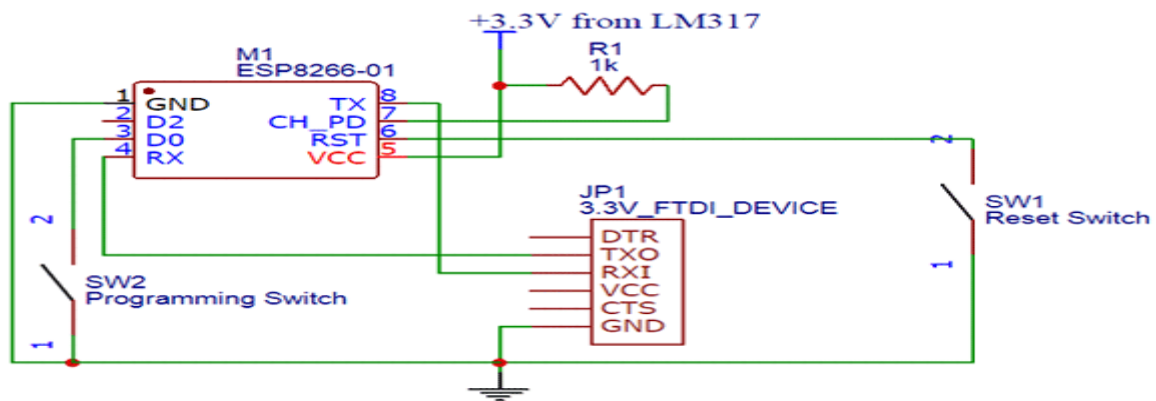


Fig:3.2.7 : ESP8266-01 module

3.2.7.1 GPIO PINS

The GPIO's appeared in blue box (1, 3, 9, 10) are generally not utilized for GPIO reason on Dev Kit.ESP8266 is a framework on a chip (SoC) plan with segments like the processor chip. The processor has around 16 GPIO lines, some of which are utilized inside to interface with different segments of the SoC, similar to streak memory. Since a few lines are utilized inside the ESP8266 SoC, we have around 11 GPIO pins staying for GPIO reason.

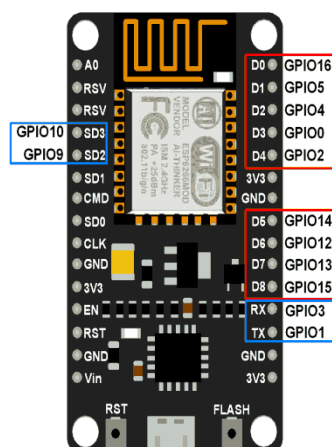


Fig:3.2.7.1 : NodeMcu GPIOs

Table 3.2.7.1 : NodeMCU GPIOs

Pin Names on NodeMCU Development Kit	ESP8266 Internal GPIO Pin number
D0	GPIO16
D1	GPIO5
D2	GPIO4
D3	GPIO0
D4	GPIO2
D5	GPIO14
D6	GPIO12
D7	GPIO13
D8	GPIO15
D9/RX	GPIO3
D10/TX	GPIO1
D11/SD2	GPIO9
D12/SD3	GPIO10

Presently again 2 pins out of 11 are for the most part held for RX and TX to speak with a host PC from which accumulated article code is downloaded. Hence at last, this leaves only 9 broadly useful I/O pins for example D0 to D8.As appeared in above figure of NodeMCU Dev Kit. We can see RX, TX, SD2, SD3 pins are not for the most part utilized as GPIOs since they are utilized for other interior interaction. However, we can attempt with SD3 (D12) pin which generally prefer to react for GPIO/PWM/interfere with like functions. Note that D0/GPIO16 pin can be just utilized as GPIO read/compose, no uncommon capacities are upheld on it.

3.2.7.2 ESP-12E MODULE

The development board equips the ESP-12E module containing ESP8266 chip having Tensilica Xtensa® 32-bit LX106 RISC microprocessor which operates at 80 to 160 MHz adjustable clock frequency and supports RTOS.

ESP-12E CHIP

- Tensilica Xtensa® 32-bit LX106
- 80 to 160 MHz Clock Freq.
- 128kB internal RAM
- 4MB external flash
- 802.11b/g/n Wi-Fi transceiver

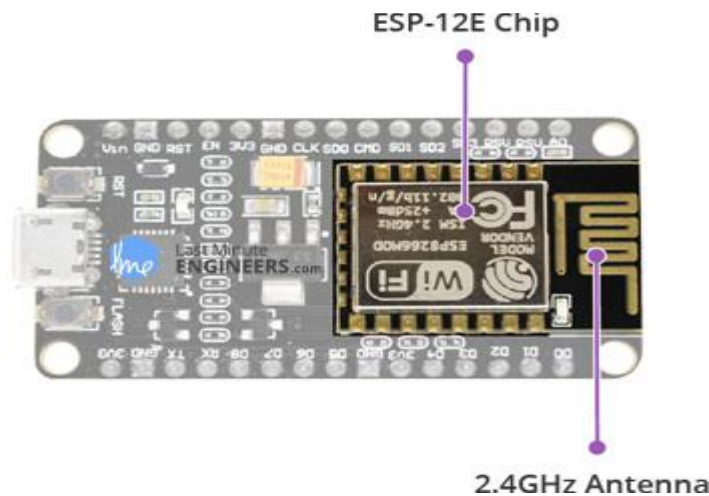


Fig:3.2.7.2 : ESP-12E Module

3.2.7.3 POWER REQUIREMENT

As the working voltage scope of ESP8266 is 3V to 3.6V, the board comes with a LDO voltage controller to keep the voltage consistent at 3.3V. It can dependably supply up to 600mA, which ought to be a very sizable amount of when ESP8266 pulls as much as 80mA during RF transmissions.

- Operating Voltage: 2.5V to 3.6V
- On-board 3.3V 600mA regulator
- 80mA Operating Current
- 20 μ A during Sleep Mode

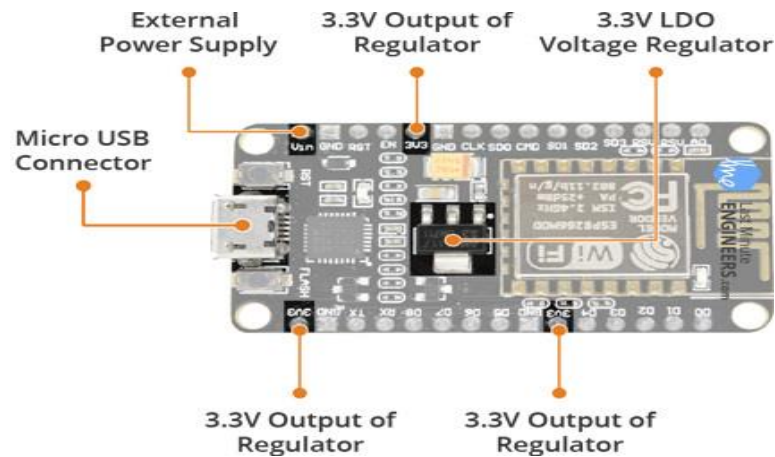


Fig:3.2.7.3 : NodeMcu Power pins

The ESP8266 requires a 3.3V force supply and 3.3V rationale levels for correspondence. The GPIO pins are not 5V-open minded! On the off chance that you need to interface the board with 5V (or higher) parts, you'll need to do some level moving.

3.2.7.4 PERIPHERALS AND I/O

The ESP8266 NodeMCU has all out 17 GPIO pins broken out to the pin headers on the two sides of the improvement board. These pins can be allotted to a wide range of fringe obligations, including

- ADC channel – A 10-bit ADC channel.
- UART interface – UART interface is used to load code serially.
- PWM outputs – PWM pins for dimming LEDs or controlling motors.
- SPI, I2C & I2S interface – SPI and I2C interface to hook up all sorts of sensors and peripherals.
- I2S interface – I2S interface if you want to add sound to your project.

3.2.7.5 MULTIPLEXED I/Os

- 1 ADC channels
- 2 UART interfaces
- 4 PWM outputs

- SPI, I2C & I2S interface

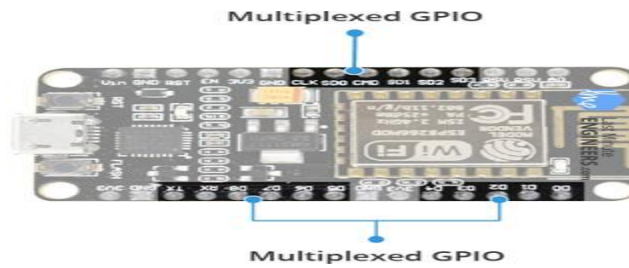


Fig:3.2.7.4 : NodeMcu Multiplexed I/Os

The ESP8266's pin multiplexing highlight (Multiple peripherals multiplexed on a single GPIO pin). Which means a solitary GPIO pin can go about as PWM/UART/SPI.

3.2.7.6 ON-BOARD SWITCHES & LED INDICATOR

The ESP8266 NodeMCU highlights two catches. One is RST & other FLASH catch.

SWITCHES & INDICATORS

- RST – Reset the ESP8266 chip
- FLASH – Download new programs
- Blue LED – User Programmable

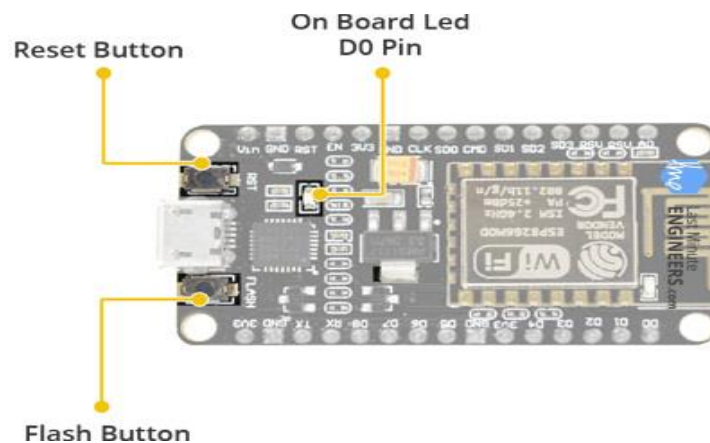


Fig:3.2.7.5 : NodeMcu switches and indicators

The nodemcu board consists of a LED indicator which is an user programmable and it is connected to D0 pin of the board.

3.2.7.7 SERIAL COMMUNICATION

It is meant by sending a data of single bit at a time consecutively at a time.

- CP2102 USB-to-UART converter
- 4.5 Mbps communication speed
- Flow Control support

USB To TTL Converter
CP2102

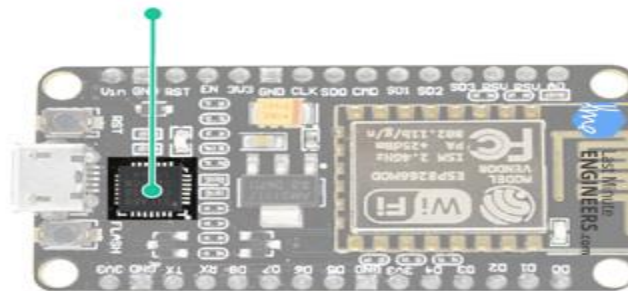


Fig:3.2.7.6 : NodeMcu CP2102 USB-to-UART Bridge Controller

3.2.7.8 ESP8266 NODEMCU PINOUT

The ESP8266 NodeMCU consist of 30 pins The connections are as follows:

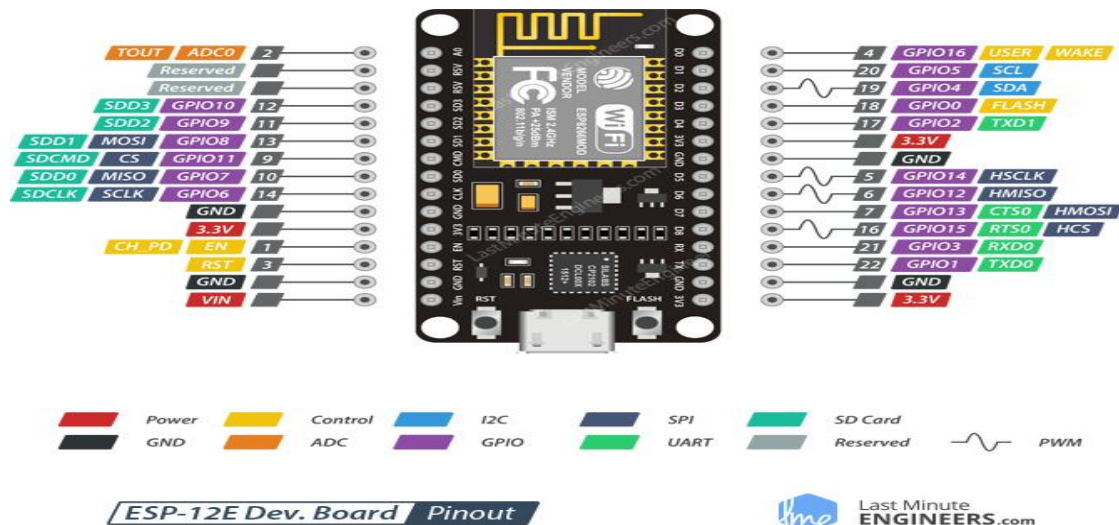


Fig:3.2.7.7 : NodeMcu Pin Configuration

Power Pins

There are four pins one VIN pin and three 3.3V pins for power transfer.

GND

GND is used for ground connection of ESP8266 NodeMCU.

I2C Pins

I2C Pins are used to hook up all sorts of I2C sensors and Peripherals. Both I2C Master and I2C Slave are supported.

GPIO Pins

ESP8266 NodeMCU consists of 17 GPIO pins which can be appointed to different capacities like I2C, I2S etc. Each advanced empowered GPIO can be designed to interior draw up. At the point when designed as an information, it can likewise be set to edge-trigger or level-trigger to produce CPU intrudes.

ADC Channel

The NodeMCU is implanted with a 10-cycle exactness SAR ADC. The two capacities can be carried out utilizing ADC viz.

UART Pins

It is mainly used for serial communication.

SPI Pins

It has two SPIs (SPI and HSPI) in slave and expert modes. These SPIs additionally support the accompanying broadly useful SPI highlights:

- 4 planning methods of the SPI design move
- Up to 80 MHz and the isolated clocks of 80 MHz

SDIO Pins

It is used for straightforwardly interface SD cards.

PWM Pins

The board has 4 channels of PWM. The PWM yield can be executed Control Pins automatically and utilized for driving computerized engines and LEDs. PWM recurrence range is customizable from 1000 μ s to 10000 μ s.

- EN pin – The ESP8266 chip is empowered when EN pin is pulled HIGH. When pulled LOW the chip works at least force.
- RST pin – RST pin is used to reset.
- WAKE pin – Wake pin is used to wake.

CHAPTER 4

ARDUINO SOFTWARE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a content manager for composing code, a message region, a book support, a toolbar with catches for normal capacities and a progression of menus. It associates with the Arduino and Genuino equipment to transfer programs and speak with them.

4.1 WRITING SKETCHES

Projects composed utilizing Arduino Software (IDE) are called outlines. These representations are written in the content tool and are saved with the document expansion .ino. The proofreader has highlights for cutting/gluing and for looking text. The message territory criticises when saving and selling, as well as displaying errors. The support displays text produced by the Arduino Software (IDE), such as total error messages and other information. The arranged board and sequential port can be seen in the bottom righthand corner of the window.



Verify

Checks for errors in the code after compiling it.



Upload

Compiled code is uploaded into the configured board.

Note: If external programmer is used by you with

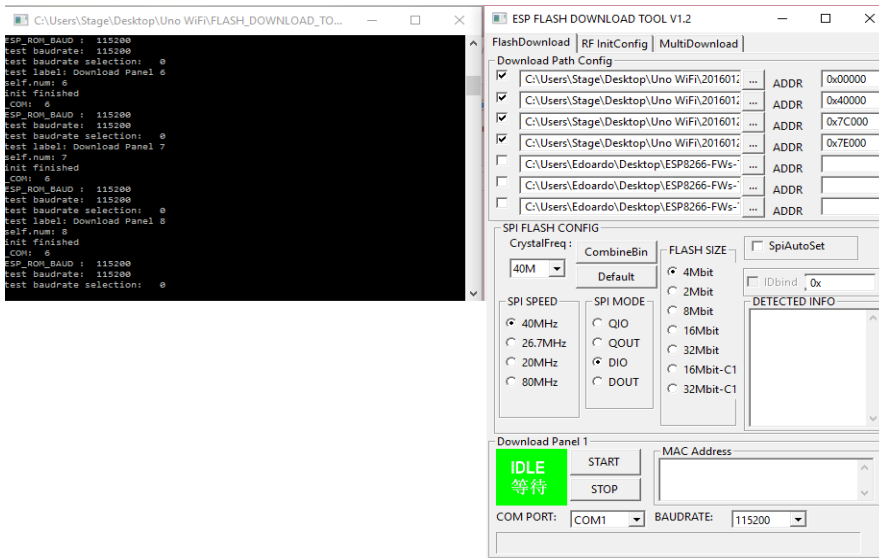
your board, then you can hold the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

New
Creates a new sketch.

Open
Presents a menu of the multitude of portrayals in your sketchbook. Clicking one will open it inside the current window overwriting its substance.

Save
Saves your sketch.

Serial Monitor
Opens the serial



monitor.

The five menus File, Edit, Sketch, Tools, and Help include additional commands. The menus are context sensitive, which means they only display things that are important to the work being done at the time.

4.2 FILE

- *Open*

It is used to open existing files

- *Open Recent*

Used to recent files

- *New*

It is used with the absolute minimum design of sketch effectively in places

- *Close*

It closes the Arduino software.

- *Save*

It recovers the sketch with the correct name

- *Save as*

It permits to save the current sketch with another name

- *Page setup*

It shows the Page setup tab mainly used for printing purpose

- *Print*

It sends the written text to printer and it follows page setup app

- *Preferences*

It is used to redone some of the settings of IDE

- *Quit*

It shutdown all the IDE windows

4.3 EDIT

- *Fix/Redo*

While altering, it returns atleast 1 stage

- *Cut*
Eliminates the copied text from the proofreader
- *Copy*
It again selects the printed text in the manager
- *Copy for Forum*
Duplicates the code of your sketch to the clipboard in a structure reasonable for presenting on the gathering,total with punctuation shading.
- *Paste*
Text is placed of the clipboard at the curser position.
- *Comment/Uncomment*
Puts or eliminates the text
- *Increase/Decrease Indent*
Adds or deducts a space at each front line.

4.4 SKETCH

- *Verify/Compile*
Checks for errors & compiles it
- *Upload*
Compiles and uploads the parallel record
- *Include Library*
It is used to collect the statements started with # from the library.
- *Add File*
It adds a source records from the text

4.5 TOOLS

- *Auto Format*
This organizes text pleasantly
- *Archieve Sketch*
Archieves a duplicate of the present code in the form of .zip design.
- *Fix Encoding and Reload*

Fixes potential errors between the supervisor single map encoding and other working frameworks burn maps.

- *Board*

Selects the board

- *Port*

Used to select the particular port

4.6 HELP

Easy access to various records that come with the Arduino Software can be found here (IDE). Without a web connection, you access Getting Started, Reference, this IDE manual, and various reports locally. The reports are a localised version of the online versions.

4.7 SKETCHBOOK

Sketchbook is being used by the IDE: a norm spot to save outlines. The sketchbook can be opened from the File > Sketchbook menu or from the Open catch on the toolbar. It will consequently make an index for your sketchbook. You can view or change the area of the sketchbook area from with the Preferences discourse.

Records are saved with a .ino document. Past forms utilize the .pde augmentation. You may in any case open .pde named records in variant 1.0 furthermore, the product consequently rename the augmentation to .ino.

4.8 TABS, MULTIPLE FILES, AND COMPILATION

It permits to check outlines with more than one record.

4.9 UPLOADING

To transfer the code it needs to be select right things Tools > Board and Tools > Port menus.

4.10 LIBRARIES

It is used to collect the statements started with # from the library. To use a library, select it from the Sketch > Import Library menu.

4.11 THIRD-PARTY HARDWARE

The peripheral devices can be connected to the arduino using third-party hardware to uninstall, essentially remove catalog.

4.12 SERIAL MONITOR

It shows the important information that is sent by the arduino. To send information to the board, enter text and snap on the "send" button or press enter.

4.13 PREFERENCES

A few inclinations is controlled by the inclinations exchange and the remaining is found in the inclinations document.

4.14 LANGUAGE SUPPORT



It is used to support many languages like C & C++ with the help unique rules of code structuring. A software library from the wiring project is supplied by the Aurdino IDE which supplies many common input & output procedures.

4.15 BOARDS

It is used to set boundaries and records also. It is used for tranfering data effectively with the specific choice which requires to check prior to consuming bootloader.

CHAPTER 5

RESULT

The sensors that are used in project are Flow sensor, gas sensor, pH sensor and level sensor. The microcontroller is used to interface the sensor like flow sensor, level sensor, gas sensor, PH sensor. Every sensor has one's own perspective use Flow sensor is used to detect the flow rate of sewage whereas level sensor is used to monitor the level of sewage and gas sensor is used to detect the poison gases in sewage and finally pH sensor is used to check the pH level of the sewage. These sensor were interfaced with microcontroller Arduino that will consider as a transmitter side enable with Lora Transmitter. Sensors detect the values and these values are given as input to aurdino and the output received from aurdino is given to lora transmitter. Lora module is used to transfer the data to longer range communication which is a part of Wireless Sensor Network.

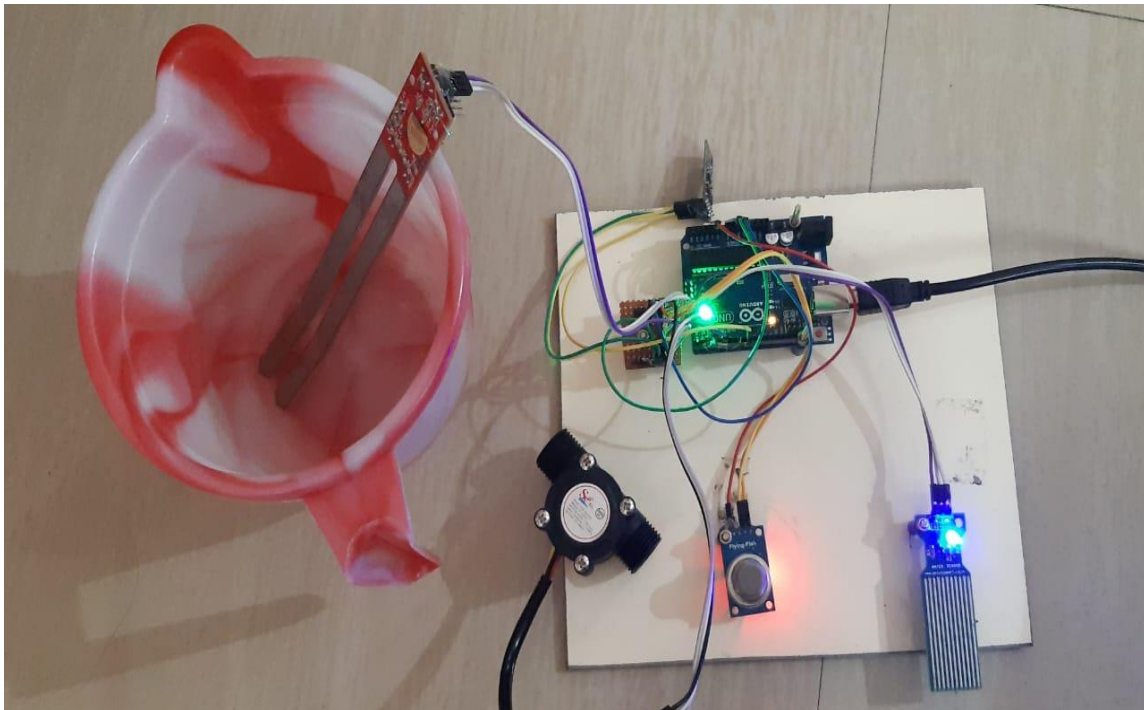


Fig:5.1 : Transmitter

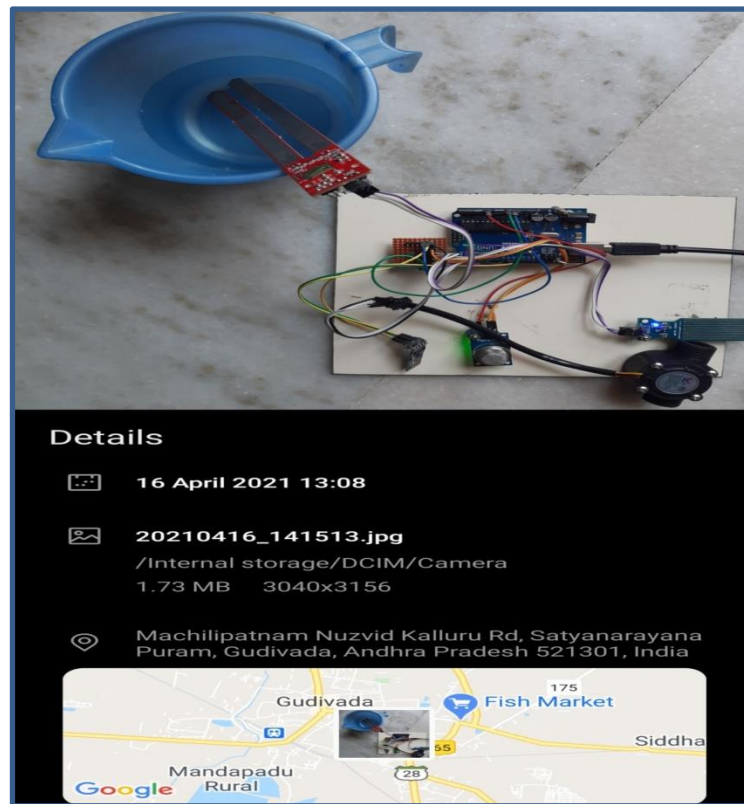


Fig:5.2 : Geo tagging photo of transmitter

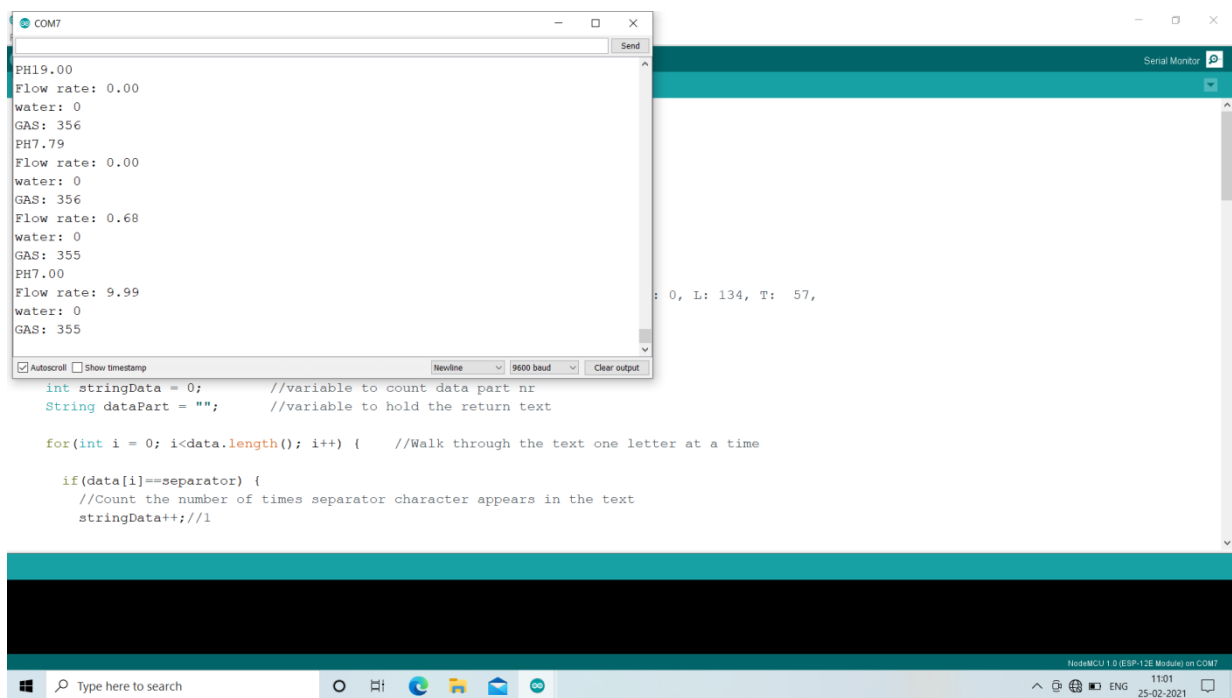


Fig:5.3 : Values at Transmitter side

At the receiver side consisting of a microcontroller named as NodeMcu which is going to be receiver side controller enable with Lora Receiver. Since the NodeMcu module can act as both a hotspot and a station it can quickly retrieve data and upload it to the internet, making IoT as simple as possible. NodeMcu which is wifi enabled, receives the data from lora and used to transmit the data to the authorities using mqtt protocol and also alert messages can be displayed LCD display to the parameters. If there are any values greater than the threshold , alert message will be displayed on 16*2 lcd screen as well as on mobile using mqtt protocol. The Lora Receiver is used here to receive the corresponding data from the Lora transmitter with help of a microcontroller.

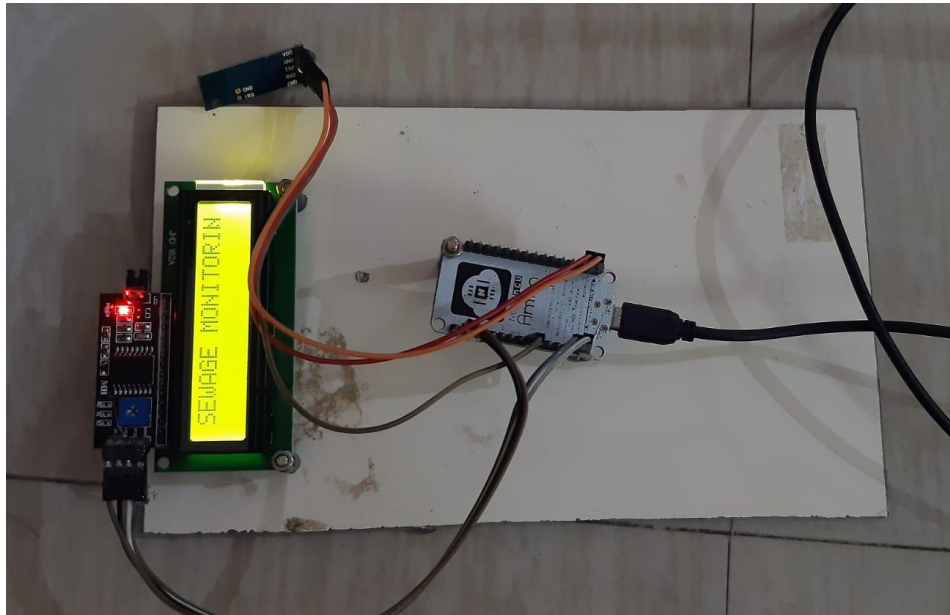


Fig:5.4 : Receiver



Fig:5.5 : Geo tagging photo of Receiver

The below figure indicates wifi connection. NodeMcu which has inbuilt wifi module provides wifi and it is used to connect MQTT protocol. In case if wifi is not connected it displays a message that it is not connected.

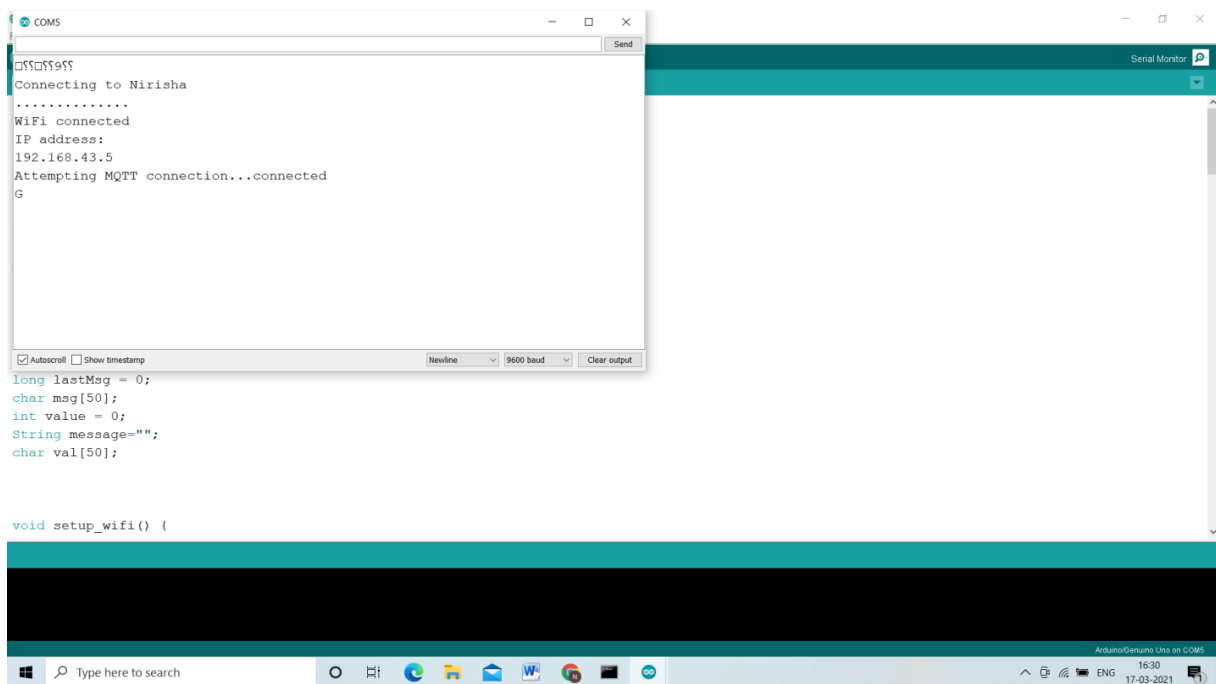


Fig:5.6 : Connecting to wifi

If gas values are high, then the transmitter transmits a variable 'G' to receiver. Here the variable 'G' indicates that higher gas values have been detected in the sewage and also displays a message that clear immediately in 16x2 LCD display.

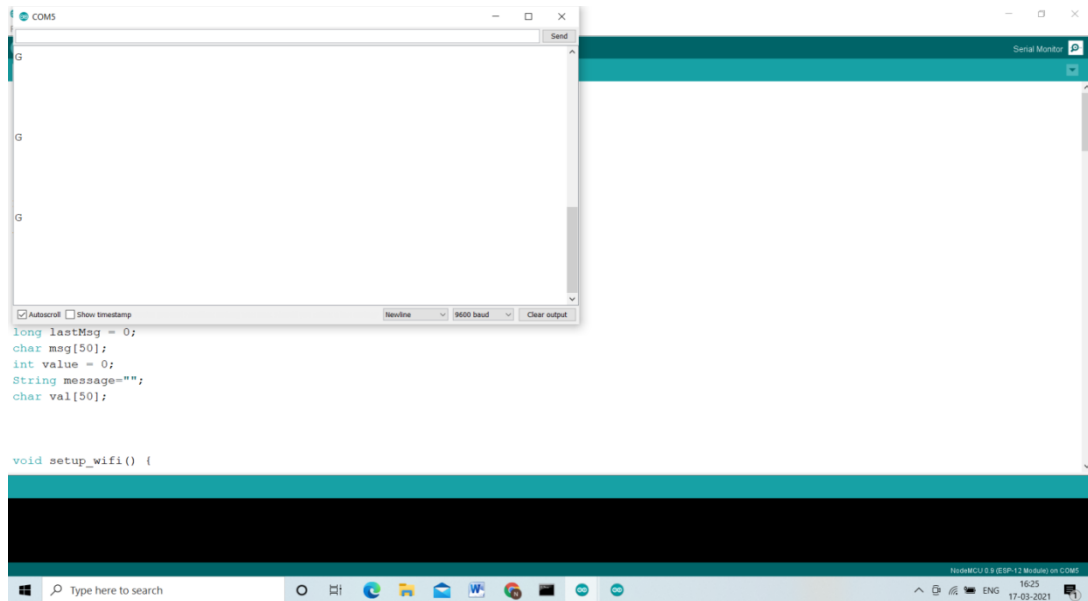


Fig:5.7 : Alert message for Gas Sensor

If the pH of sewage is high, then the transmitter transmits a variable 'P' to receiver. Here the variable 'P' indicates that higher pH values have been detected in the sewage and also displays a message that clear immediately in 16x2 LCD display.

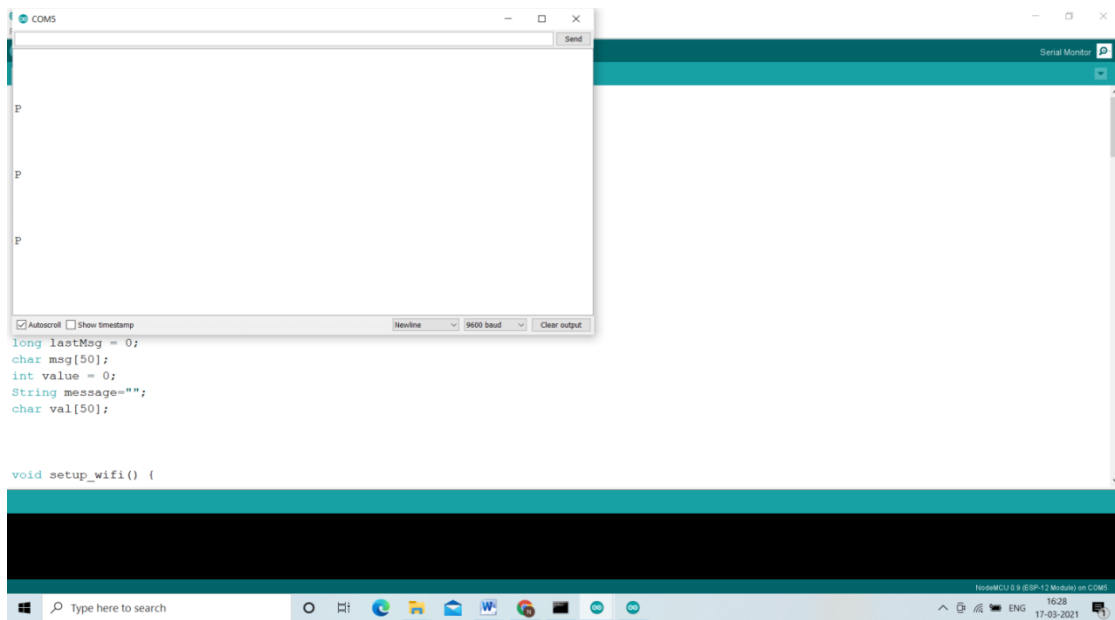


Fig:5.8 : Alert message for pH Sensor

If level of sewage is high, then the transmitter transmits a variable 'R' to receiver. Here the variable 'R' indicates that higher water level has been detected in the sewage and also displays a message that clear immediately in 16x2 LCD display.

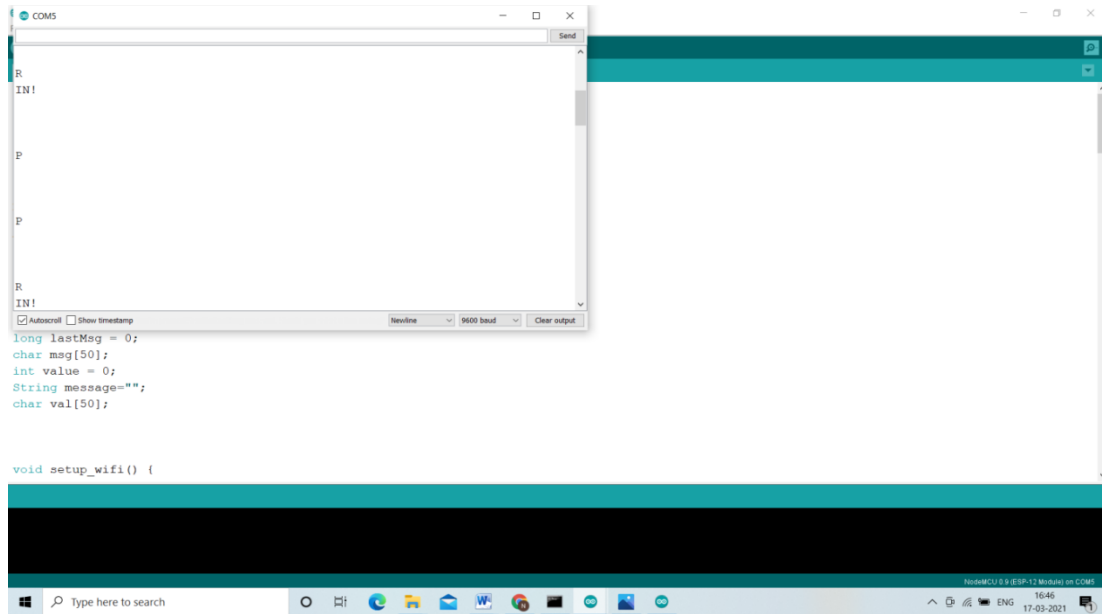


Fig:5.9 : Alert message for Level Sensor

If overflow of sewage occurs, then the transmitter transmits a variable 'Y' to receiver. Here the variable 'Y' indicates that overflow has been detected in the sewage and also displays a message that clear immediately in 16x2 LCD display

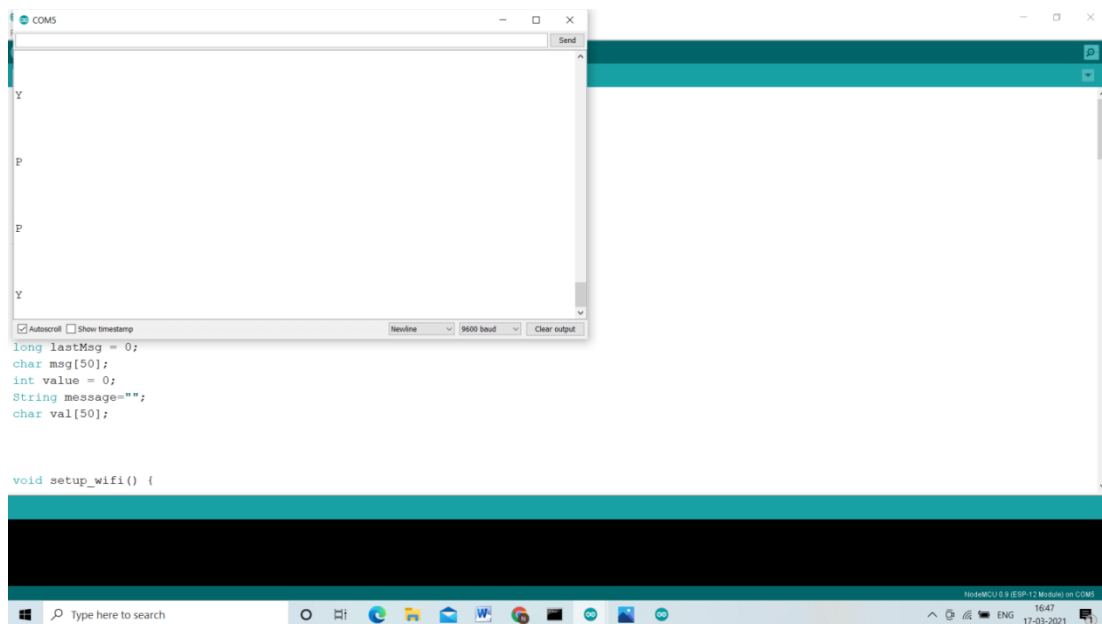


Fig:5.10 : Alert message for Flow Sensor

MQTT convention is an OASIS standard informing convention for the Internet of Things. It is planned as an amazingly lightweight distribute/buy in informing transport that is ideal for interfacing far off gadgets with a little code impression and insignificant organization bandwidth.

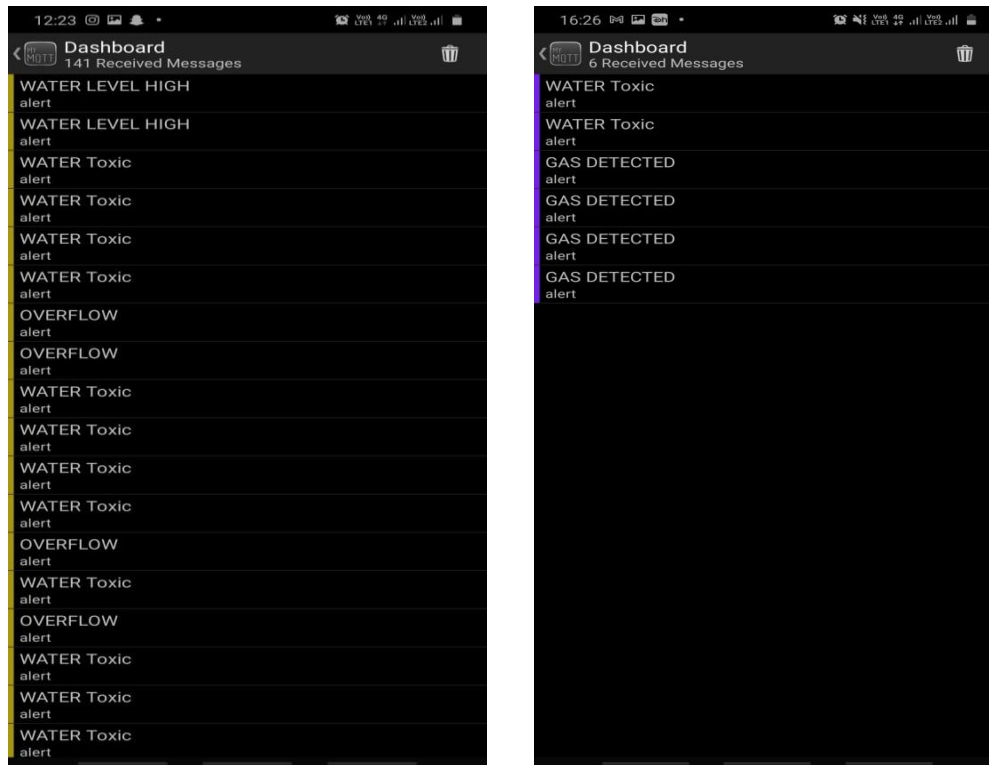


Fig:5.11 : Alert messages over mobile

The 16x2 LCD display displays if any gases are detected, overflow of sewerage, high water level and any toxic gases.

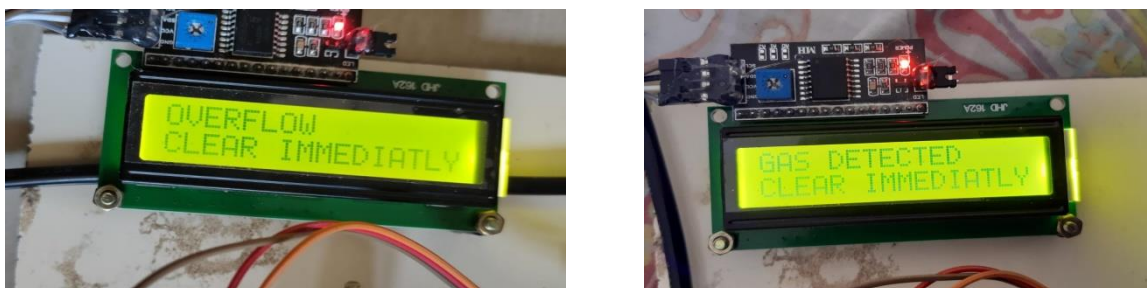




Fig:5.12 : Alert Messages on 16x2 LCD display

CHAPTER 6

CONCLUSION

The sensor unit recognizes every noticeable boundary, for example, gaseous tension, water level, blockage, smoke brought about by synthetic and gas outflows in the shaft, and converts these contributions to control yields. These concentrates are identified as arduino and introduced in the module and masterminded in one of them. This is a method of sending all data to the worker occasionally, and afterward the site shows all constant readings and notice subtleties of all hubs in clear content on the graph. The S text of the online content is additionally shipped off the predefined cell phone number with hub data and alerts. Neural organization is viewed as a significant hub worldview asset of clever ongoing sewage observing framework in significant urban communities. By utilizing different sensors, (for example, gas location, water level and identification recognition), we can check the genuine status of the disinfection framework by recognizing issues in the sterilization framework. Thusly, we will actually want to make certain strides in light of the issue, since we will get early notification of the boycott and tax increment. The undertaking can be utilized to plan an insightful constant sterilization framework to screen and tackle issues.

REFERENCES

- [1] J. L. Campos, D. Valenzuela-Heredia et al.(April, 2016) "Greenhouse Gases Emissions from Wastewater Treatment Plants: Minimization, Treatment, and Prevention, ", Journal of Chemistry, vol. 2016, . . Apr.2018

- [2] Yiyang Wang "Stable Adaptive Fuzzy Control of Wastewater Treatment Plants," Thesis by UNIVERSITY OF CALGARY, ALBERTA, April 2019

- [3] Xianjun Du, Junlu Wang, Veeriah Jegatheesan and Guohua Shi "Dissolved Oxygen Control in Activated Sludge Process Using a Neural Network-Based Adaptive PID Algorithm," Applied Sciences, vol. 8,,., Feb. 2018.

- [4] Xiaohu Dai, Chongliang Hu, Dong Zhang and Yinguang Chen "A new method for the simultaneous enhancement of methane yield and reduction of hydrogen sulfide production in the anaerobic digestion of waste activated sludge," Bioresource Technology, vol. 243,. ,pp 914-921, Nov. 2017.

- [5] Do Van Manh, Truong Thi Hoa, Nguyen Viet Thoan, Do Tuan Anh, Nguyen Tuan Minh and Le Minh Tuan "Combination of Moving bed Biofilter and activated sludge process to remove organic loading from seafood wastewater," Vietnam Journal of Science and Technology, vol. 55, no. 6,, , Dec. 2017

- [6] Deborah Panepinto, Silvia Fiore, Mariantonia Zappone, Giuseppe Genon and Lorenza Meucci "Evaluation of the energy efficiency of a large wastewater treatment plant in Italy," Applied Energy, vol. 161,,pp. 404-411, Jan. 2016.

[7] Bo Ying-Chun and Zhang Xi “Online adaptive dynamic programming based on echo state networks for dissolved oxygen control,” *Applied Soft Computing*, vol. 62,,pp. 830-839, Jan. 2018 .

[8] Félix Hernández-del-Olmo, Elena Gaudioso, Raquel Dormido and Natividad Duro “Energy and Environmental Efficiency for the NAmmonia Removal Process in Wastewater Treatment Plants by Means of Reinforcement Learning,” *Energies*, vol. 9, no. 9, pp.755, Sep. 2016.

[9] Mei-Jin Lin and FeiLuo “Adaptive neural control of the dissolved oxygen concentration in WWTPs based on disturbance observer,” *Neurocomputing*, vol. 185,, pp. 133-141, Apr. 12.

[10] Reddy, B. H. Nanjunda, Kumar, T. M. Mohan, Lakshmi, V. Venkata(February, 2017) “Synthesis and Characterization of Sodium Alginate Stabilized Nano-ZnO Impregnated into Bentonite Clay,” *Journal of Bionanoscience*, vol. 11, no. 1, pp. 59-65, Feb. 2017.

Sind

ORIGINALITY REPORT

9%

SIMILARITY INDEX

9%

INTERNET SOURCES

0%

PUBLICATIONS

9%

STUDENT PAPERS

PRIMARY SOURCES

1

lastminuteengineers.com

Internet Source

5%

2

docplayer.net

Internet Source

3%

Exclude quotes ☒ On

Exclude matches ☒ < 3%

Exclude bibliography ☒ On