

IOT BASED WATER HARVESTING SYSTEM

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering degree

in

Electronics and Communication Engineering

by

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**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-600119

APRIL-2023



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Final Year Project Report is the bonafide work of M.Sunil kumar (39130272), K. Harish kumar (39130225) who carried out the project entitled "IOT BASED WATER HARVESTING SYSTEM" under our supervision from November 2022 to April 2023.

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DECLARATION

We M.Sunil kumar (39130272), K.Harish kumar (39130225) here by declare that the Project Report entitled “**IOT BASED WATER HARVESTING SYSTEM**” done by us under the guidance of **Dr. M.R.EBENEZAR JEBARANI ,M.E., Ph.D.,** at **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

PLACE: CHENNAI

DATE: 23.04.2023

SIGNATURE OF THE STUDENT

1



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ABSTRACT

In this, the theory on real time monitoring of water quality in IoT environment is presented. By incorporating a smart water management system, Rainwater management will gain the ability to store the excess water in a smarter way by utilizing new technology, which deals with the modules like sensors, Arduino processors etc.

In this project, the water flowing besides the roads gets into the filtration tank where it consists of five to six layer of natural filtration elements like sand, rock, gravels, and cloth sheets etc. The collected filtered water can be used for irrigation and different applications besides of our daily needs like drinking water and livestock. Instead of getting the water dirtied by overflowing of rainwater, it can be stored and used for irrigation and many other purposes like underground rock storage. By using the different sensors for different applications like water level, water turbidity, water PH level. The proposed model utilizes the rain water flowing on the roads in a proper way.

Collecting rainwater reduces soil erosion, stormwater runoff, flooding and the pollution of surface water from fertilizers and pesticides. Rainwater is an excellent source for landscape irrigation and reduces the demand on ground water. Water is a fundamental segment in each part of life and must be esteemed and shielded. It is the most significant assets for endurance of person as much as food, air and so forth, however not many considerations are paid for its practical use and protection of this valuable asset.

The most common method to detect these parameters is to collect samples manually and then send them to laboratory for detecting and analysing. This method wastes too much man power and material resource, and has the limitations of the samples collecting, long-time analysing, the aging of experiment equipment and other issues. Sensor is an ideal detecting device to solve these problems. It can convert no power information into electrical signals. It can easily transfer process, transform and control signals, and has many special advantages such as good selectivity, high sensitivity, fast response speed and so on. According to these characteristics and advantages of sensors, Monitoring of Turbidity, PH & Water Level is designed and developed.

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CHAPTER-1

1.1.INTRODUCTION

With the rapid development of the economy, more and more serious problems of environment arise. Water pollution is one of these problems. Routinely monitored parameters of water quality are temperature, pH, turbidity, conductivity, dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), ammonia nitrogen, nitrate, nitrite, phosphate, various metal ions and so on. The most common method to detect these parameters is to collect samples manually and then send them to laboratory for detecting and analysing. This method wastes too much man power and material resource, and has the limitations of the samples collecting, long-time analysing, the aging of experiment equipment and other issues. Sensor is an ideal detecting device to solve these problems. It can convert no power information into electrical signals. It can easily transfer process, transform and control signals, and has many special advantages such as good selectivity, high sensitivity, fast response speed and so on. According to these characteristics and advantages of sensors, Monitoring of Turbidity, PH & Water Level is designed and developed.

The groundwater level is depending on the rate of water sink into the earth layers, due to multiple reasons rate at which water is taken from the ground is not equal to the rate at which water goes back into the ground hence leads to scarcity of water at various places on earth. water harvesting is the process of collecting, storing, purifying and conveying rainwater. Rainwater harvesting is cost efficient and conserves water and energy. Collecting rainwater reduces soil erosion, stormwater runoff, flooding and the pollution of surface water from fertilizers and pesticides. Rainwater is an excellent source for landscape irrigation and reduces the demand on ground water. Water is a fundamental segment in each part of life and must be esteemed and shielded. It is the most significant assets for endurance of person as much as food, air and so forth, however not many considerations are paid for its practical use and protection of this valuable

asset. Due to over siphoning of ground water, the water table is going down anomalous and on the off chance that the issue isn't given a genuine look, at that point the people in the future may need to confront serious shortage of water. Precipitation is the prime wellspring of water. Like many other cities of India, in Maharashtra State, Pune city is blessed with plenty of rainfall. The only concern is to tap this valuable resource which pours in the form of rains during the rainy season. Despite its immense usefulness, fail to conserve the most valuable resource. Rain Water Harvesting (RWH) is increasingly viewed as a major strategy for enhancing the present condition of water crises especially in the dry seasons. The effective implementations and working of the systems is still a big challenge. Water reaping is the fate vital in the Socio-Economic improvement of the urban areas, where water sources are scant or dirtied. We, today wholly and solely depend upon the dams for day to day water supply. Yes, the government has shouldered the responsibility by making necessary compliances for the builders who build the housing societies with regards to Rain Water Harvesting (RWH). Despite there being water scarcity in many parts of the city, citizens don't seem keen to harvest rainwater. The city has saved only 12 million liters a day (MLD) of water through rainwater harvesting. This came to light from a study conducted by the Green Energy Foundation (GEF). But there still is space to augment the use of rain water through efficient conservation of rainwater through Rain Water Harvesting System (RWHS). Water shortage is one of the critical problems in Chennai. This problem is not new one, and it cannot be solved overnight.

The water table is lowering day by day, and the recharge of groundwater table is facing difficulties because of the pavements and concrete roads. Water gathering is a powerful choice not exclusively to revive the groundwater spring yet additionally to give satisfactory capacity of water for sometime later. Certainly this reservoir of water underneath the ground could be of great use for flourishing days, as well critical period of the year. This system is a suitable sustainable option for providing water. It is almost the only way to upgrade one's community water supply. The installers of RWHS have installed the RWHS to meet the

compliance put forth by the government for housing societies build up after 2008. But meeting this compliance will certainly help in reserving of the water table beneath the ground. Some definitional limits are required to direct urban communities inside the undertaking. Within the innovative power of any town tenant in india, the photograph of a shrewd town incorporates a listing of things to get of framework and administrations that depicts his or her level of craving. So the smart city major problem is rain water harvesting, The annual inter-State feuds over water are becoming more and more common in India. Per capita water availability in the country which was 5,000 cubic meters earlier, has dropped to 2,200 cubic meters. This is against the world figure of 8,500 cubic meters. As a result, India is fast approaching a phase of stressed water availability conditions. Several perennial flows like the Ganga-Brahmaputra-Barak are becoming seasonal. Rivers are dying or declining and aquifers are getting over-pumped. Thus, people have to depend on limited municipal water supply. Consequently, they are forced to rely on their own resources. This scarcity has led to the birth of water markets with private entrepreneurs doing business in supplying water tankers. No clear ecologically stable and financially viable solution has emerged. The poor state of local and municipal authorities renders them unable to provide basic water to the cities. Strengthening of local bodies could lead to another means of addressing this issue. To prevent that the water wastage can be reduced as shown in Figure1.1.

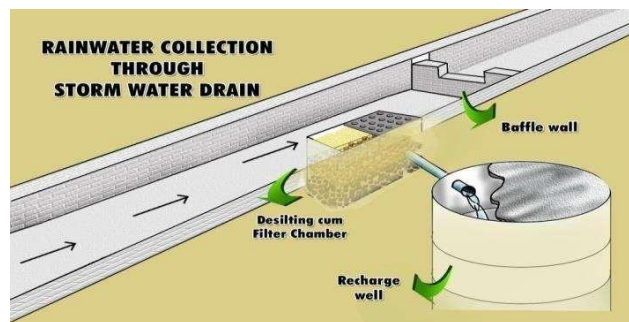


Figure.1.1.water harvesting

1.2.Objectives of IOT based water harvesting

The primary objective of iot based water harvesting is reasonable and sustainable usage and recycling of water resources. Growing population, increasing environmental issues and pressure on the food and agriculture sector make water even a more precious asset.

In this respect, water management technologies and activities pursue the following objectives:

1. **Reduce wasting water** used in high volumes for agriculture, manufacturing, power production. It implies the introduction of high-tech practices like precision farming, smart irrigation, crop water management, real-time water metering and other applications of internet of things in agriculture. Learn about agriculture software development services.
2. **Improve water quality** and prevent contamination by chemical waste and natural pollution such as acidification.
3. **Enhance the efficiency of water systems** such as water collectors, treatment plants, distribution mains and wastewater recycling centers. Using IoT and data solutions for asset management, companies can keep important measurements such as water pressure, temperature, flow, etc. at hand, integrate predictive maintenance and avoid breakage and downtime of equipment.
4. **Practice consumption monitoring** via IoT-based water management systems. It helps to optimize and keep under control the usage of water resources at different levels households, communities, countries and the whole planet.
5. DownpWater Harvesting is the assortment and capacity of water for reuse nearby, as opposed to permitting it to run off. These put away waters are utilized for different purposes.
6. Precipitation is the principle wellspring of water which is to be protected for sometime later.

7. Catchments: The catchment of a water reaping framework is the surface which legitimately gets the precipitation and gives water to the framework. It very well may be a cleared zone like a patio or yard of a structure, or an unpaved territory like a garden or open ground. Coarse work at the rooftop to forestall entry of trash.
8. Conveyance frameworks (canals) to move the water from the rooftop or assortment surface to the capacity supply. First-flushing-A first flush gadget is a valve that guarantees that spillover from the main spell of downpis flushed out and doesn't enter the framework. This should be done since the principal spell of downpconveys a generally bigger measure of toxins from the air and catchment surface.
9. The channel is utilized to expel suspended toxins from water gathered over rooftop. A channel unit is a chamber loaded up with sifting media, for example, fiber, coarse sand and rock layers to expel trash and soil from water before it enters the capacity tank or energizes structure. Charcoal can be added for.
10. Additionally there are a wide variety of systems available for treating water either before, during and/or after storage (e.g. biosand filter, SODIS, chlorination; or in general HWTS).
11. An extraction gadget (contingent upon the area of the tank) might be a tap, rope and can, or a siphon or an invasion gadget for the situation the gathered water is utilized for well or groundwater revive.

CHAPTER-2

LITERATURE SURVEY

LITERATURE REVIEW

Nikhil Kedia(2015) entitled “Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project.” Published in 2015 1st International Conference on Next Generation Computing Technologies (NGCT-2015) Dehradun, India. This paper highlights the entire water quality monitoring methods, sensors, embedded design, and information dissipation procedure, role of government, network operator and villagers in ensuring proper information dissipation. It also explores the Sensor Cloud domain. While automatically improving the water quality is not feasible at this point, efficient use of technology and economic practices can help improve water quality and awareness among people.

Boers & Asher (1981) addressed the design aspects of MCWH befitting the size of collecting area and layout to the contributing area owing to kinematic wave equation and dynamic equation with picturing the rainfall inducement and collection. The advantage of MCWH over RFWH is that threshold retention is much greater than RFWH and has high specific runoff yield than other small catchments whereas RFWH is limited to just farming and agro based needs. The factors determining the various features of MCWH and RFWH are determined for model development IB and SR.

Goel & Kumar (2004) proposed a generalization to find the best suitable economic analysis of watershed in rain water harvesting. The purpose was to increase the agricultural productivity and minimize soil erosion the mountainous region of India. With an estimated life of water retaining structures of different sizes ageing 25 to 40 years, the ratios were found out to be 0.41 to 1.33. The PVANR i.e. valuation of construction and maintenance for present value was \$215/ ha. Made on the basis of sizes and the value decreased with the increase

in the size of the structure. It was projected that the overall expenditure projected was around 15.15-2.20 m US\$ and the net income from the proposed catchment plan would be around 1.18-3.86 m. hence it underlined that projected cost will be recovered in 13.17 years if the minimum life span of structure is 25 years.

Gupta & Sisodia (2019) showed that how the rain water can be used for different purposes and how its utilization can decrease load on the underground aquifers. The area of design was in a university in a semi-arid region of Rajasthan which receives rainfall less than 669 mm annually. The study was conducted over three surfaces concrete roof, hard pavement and garden respectively and was found that the overall system was efficient 70% for the concrete roof, 60% for the hard pavements for total rainfall. To predict the exact amount of water collected and its efficiency adequate runoff coefficients according to the surface and its material are selected. In the analysis, the system improved 10% of the daily inefficiency per student in the summer for around 4 months.

Helmreich & Horn (2008) gave general model of the RWH in semi-arid region of sub Saharan Africa where discrete water flow components are used for the rainfall partitionings. The soil evaporation accounts for 30-50% of the losses and 10 to 25% is surface runoff whereas the surface runoff is subsequently increased when the surface is hard and paved. It was then combined with the statistical data depicting the demand satisfied with the tank size and was found that the graph tends to get linear with the increase in the size of the tank.

Jasrotia et al. (2009) proposed a method for a water balance approach of rain water harvesting using GIS techniques and remote sensing techniques. Judicial of the depleting and limited fresh water resources the study was conducted in Devak rui watershed in J&K where the remote sensing and GIS approach was taken to resurface information about watershed boundary drainage and network boundary by the integration of land use map a defined map was laid out to redefine RWHS by mapping the soil texture, runoff potential and slope and contours of the region. The Thornthwaite and Mather's model was used to determine runoff and actual evapotranspiration. The overall data was then

presented as monthly variation of precipitation, potential evapotranspiration, actual evapotranspiration and runoff.

Jothiprakash & Sathe (2009) determined the number of structures and the suitable RWH method by the application of analytical processes such as analytical hierarchy process determining volume of water to be stored using mass balance method ripple diagram method, analytical method and sequent peak algorithm method. The research is also elaborated by considering economy in action if the site is considered with the site size and all the other parameters the recharging of groundwater will be the best suitable option. The area of study is a large automobile factory in Nasik Maharashtra India which has a large area of catchment. It was identified by the process the identical volume was 55000m³ resulting in fRCC cubical tank of 4m height as an appropriate choice for the catchment.

Kadam et al (2012) identified the RWH sites in part of Deccan volcanic province, India using SCSCN method which showed the high runoff potential from water body agricultural land followed by settlement open forest areas. Physical parameters were also considered for identification of structures. The study area described the hydrological soil group with physical features specific to site such as slope and runoff. It resulted in average accuracy of SCSCN 86.25% considering various structures accuracy.

Jayti Bhatt, Jignesh Patoliya (2016) entitled "Real Time Water Quality Monitoring System". This paper describes to ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this paper, present the design of IOT based water quality monitoring system that monitor the quality of water in real time. This system consists some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and this processed values are transmitted remotely

to the core controller that is raspberry pi using Zigbee protocol. Finally, sensors data can view on internet browser application using cloud computing.

Michal Lom, Ondrej Pribyl, Miroslav Svitek(2016) entitled “Industry 4.0 as a Part of Smart Cities”. This paper describes the conjunction of the Smart City Initiative and the concept of Industry 4.0. The term smart city has been a phenomenon of the last years, which is very inflected especially since 2008 when the world was hit by the financial crisis. The main reasons for the emergence of the Smart City Initiative are to create a sustainable model for cities and preserve quality of life of their citizens. The topic of the smart city cannot be seen only as a technical discipline, but different economic, humanitarian or legal aspects must be involved as well. In the concept of Industry 4.0, the Internet of Things (IoT) shall be used for the development of so-called smart products. Subcomponents of the product are equipped with their own intelligence. Added intelligence is used both during the manufacturing of a product as well as during subsequent handling, up to continuous monitoring of the product lifecycle (smart processes). Other important aspects of the Industry 4.0 are Internet of Services (IoS), which includes especially intelligent transport and logistics (smart mobility, smart logistics), as well as Internet of Energy (IoE), which determines how the natural resources are used in proper way (electricity, water, oil, etc.). IoT, IoS, IoP and IoE can be considered as an element that can create a connection of the Smart City Initiative and Industry 4.0 – Industry 4.0 can be seen as a part of smart cities.

Kumar et al. (2006) considered the critical issues for basin planning and research for rain water harvesting identifying them as water supply potential in water scarce regions, complexities in assessment due to deficiency of inflow runoff data evaluation of RWH, maximizing the hydrological benefits and cost benefits trading hydrology, optimizing upper and lower water basins, improvement in locally harvested water and reduction in the utilization of augmented water integrating the surface-ground water. The paper shadows the dark regions where economic evaluation of the water harvesting system poses several complexities on the basis of economic studies where problem is in quantity of hydrological

benefits and directed to view of action where water harvesting can be made efficacious by developing better catchment hydrology, improving wet saving and enhancing green water for harvesting.

Mishra & Tembhurkar (2018) discussed the application of filters such as sand and foam filter in combination for rooftop RWHS in buildings such that the water shortage and scarcity can be minimized with sustainable approach in storing and collection of water for the needs of future. The area selected was a girls hostel building in VNIT Nagpur campus covering 4980 m². The per capita consumption of water in a day was calculated in litre/day for all activities washing, cleaning and flushing. According to the experiments, it was found that the dual media filter combination is acceptable for treating rainwater with addition of little disinfectant like chlorine during its utilization. From experiments it was found that in this dual media filter single layer of foam works better than double layers.

Zhanwei Sun, Chi Harold Li, Chatschik Bisdikian, Joel W. Branch and Bo Yang (2012) entitled "QOI-Aware Energy Management in Internet-of-Things Sensory Environments". In this paper an efficient energy management framework to provide satisfactory QOI experience in IOT sensory environments is studied. Contrary to past efforts, it is transparent and compatible to lower protocols in use, and preserving energy-efficiency in the long run without sacrificing any attained QOI levels. Specifically, the new concept of QOI-aware "sensor-to-task relevancy" to explicitly consider the sensing capabilities offered by a sensor to the IOT sensory environments, and QOI requirements required by a task. A novel concept of the "critical covering set" of any given task in selecting the sensors to service a task over time. Energy management decision is made dynamically at runtime, as the optimum for long-term traffic statistics under the constraint of the service delay. Finally, an extensive case study based on utilizing the sensor networks to perform water level monitoring is given to demonstrate the ideas and algorithms proposed in this paper, and a simulation is made to show the performance of the proposed algorithms.

Sokratis Kartakis, Weiren Yu, Reza Akhavan, and Julie A. McCann(2016) entitled “Adaptive Edge Analytics for Distributed Networked Control of Water Systems” This paper presents the burst detection and localization scheme that combines lightweight compression and anomaly detection with graph topology analytics for water distribution networks. show that approach not only significantly reduces the amount of communications between sensor devices and the back end servers, but also can effectively localize water burst events by using the difference in the arrival times of the vibration variations detected at sensor locations. results can save up to 90% communications compared with traditional periodical reporting situations.

Patel et al (2014) defined the process of collecting and storing the rainwater and use it for domestic use in the S.P.S.V. campus and analyzed the problems with current distribution system and water use at campus. The average monthly rainfall data was stipulated in tabular form to generate the data for hydrological analysis, volume of runoff per year, rainfall potential & catchment area of building. It was found that the RWH project on the campus can fight water scarcity and can reap benefits from financial point of view.

Rahman et al (2010) examined the sustainability of rainwater collection by harvesting in multi storey apartments taking a hypothetical approach to create various scenarios related to site area and floor arrangement. The water demand was assumed that it would be only used for flushing laundry and irrigation. The life cycle costing was developed assuming material cost, maintenance and operation cost. The operation cost was estimated following pump running time and pump operating cost. It was possible to achieve “payback” under most favorable financial condition and the benefit to cost ratio is smaller with the BASIX approach than non BASIX approach.

Shrivastava et al (2019) purposed design of the rooftop harvesting system in a sea coast high rainfall zone of south Gujarat. due to nearness to the sea the area suffers ingress water supply and overexploitation of the groundwater. The study is a fyear extensive and the water studied is stored for more than 2 years for

physical chemical and micro bacterial quality assurance. The roof water was collected from 6 rooftops of the campus measuring around 3085m² in total. In the first year of study it was concluded that the water's physically had peculiar rotten smell and black residue carbon from atmosphere. The chemical quality of harvested water using RBD methods showed that the quality of water in terms of TDS is far better than ground water i.e. 1440tds. The micro bacterial quality of the water in terms of MPN of faecal coliform/100ml was observed to be less than municipal water supply however it increased with the first year of storage and then decreased extensively due to enclosed conditions of the tanks. The efficiency of different bacterial removal methods was also studied with an achievement where E.coli bacteria was not found out in any treatment.

Mithila Barabde, Shruti Danve entitled: "Real Time Water Quality Monitoring System". This proposes Quality Monitoring System for Water based on sensors. Basically they have concentrated to obtain the good quality of water with high mobility, high frequency and low powered and this is the uniqueness of this system. This system consists of nodes for data monitoring, a remote station and a base station. Data's of pH, turbidity, conductivity, etc are collected by the base station which is sent to the remote monitoring station. It displays in the PC after processing. If the value obtained is greater than the threshold value an SMS alert is sent to the station.

Vaishnavi V.Daigavane and Dr. M. A Gaikwad: - "Water Quality Monitoring System Based on IOT". In the paper it gives the design and development of the system. To measure the chemical and physical parameters several sensors are used in this system. The core controller processes the values measured by the sensors. Arduino Uno is core controller used in this paper. Finally, using the Wi-Fi module user can view the sensor data.

CHAPTER-3

EXISTING SYSTEM

Problems in existing system

In the existing system the water on the road side is just left into the sewer drains where the rain water and sewer water get mixed and cannot be used for any purpose.

But in some case the rain water flowing on the roads are let into the rain water harvesting system. The existing system consists of website monitoring. When the customer used the amount of water allotted for them then the controller will give the signal to solenoid valves, the solenoid valve will automatically cut the water supply to that particular user. As shown in Figure3.1.

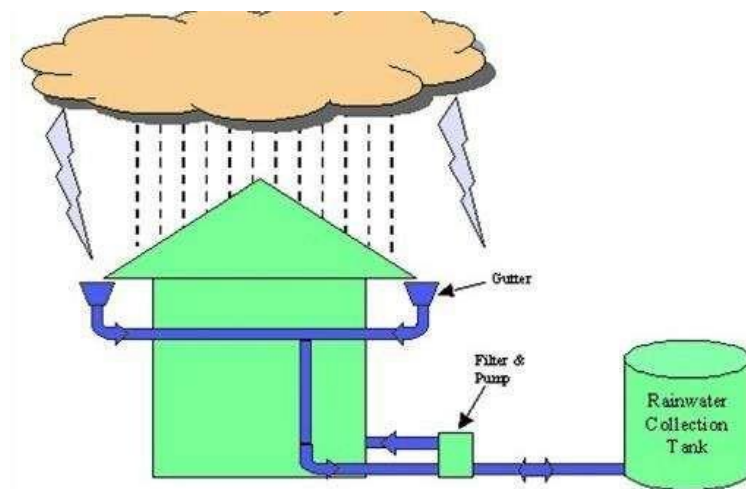


Figure.3.1.existing system

The first thing you need to consider in constructing a harvest system is the collection area, storage devices and delivery system. The collection area is anywhere where the rain showers do not fall on the earth. It can include the roof

of yhouse As shown in Figure.2.1.You need to find out how to do rainwater harvesting by discovering the amount of water that yroof can capture and how much water you need. A farmer who is located in an arid area with a large landscape of plants will need more water compared with own who has a small vegetable yard. The more drums that you have the more rainfall you will capture. The storage devices can either be containers or drums. You also have the option of constructing yown. In either ways, the main aim is to ensure that they are located appropriately. It is good to place it near the place where water is needed most. Dig a three inches extent and broadness of ycinder block bottom. Put gravel in the area up to a level of a third of it. This is so as to make sure yfoundation is water-free all the time by flattening the cinder blocks.

CHAPTER-4

PROPOSED SYSTEM

4.1 HARDWARE REQUIREMENTS

PH sensor:

IT is an IoT device that identifies the level of acidity in a wide variety of liquids. The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with arduino. The normal range of pH is 6 to 8.5. ph sensor is shown in Figure 4.1



Figure 4.1 Ph sensor

Characteristics:

- Transmission of data to the gateway via LoRaWAN™ protocol
- IP68 protection grade (sensor)
- IP20 protection grade (transmitter)

Dimensions: 4.37" x 3.38" x 1.61" (111 mm x 86 mm x 41)

Turbidity sensor:

Turbidity is a measure of the cloudiness of water. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity. As shown in Figure 4.2.

When measuring turbidity, most often, you will see the units NTU or JTU.

- NTU = Nephelometric Turbidity Units
- JTU = Jackson Turbidity Units

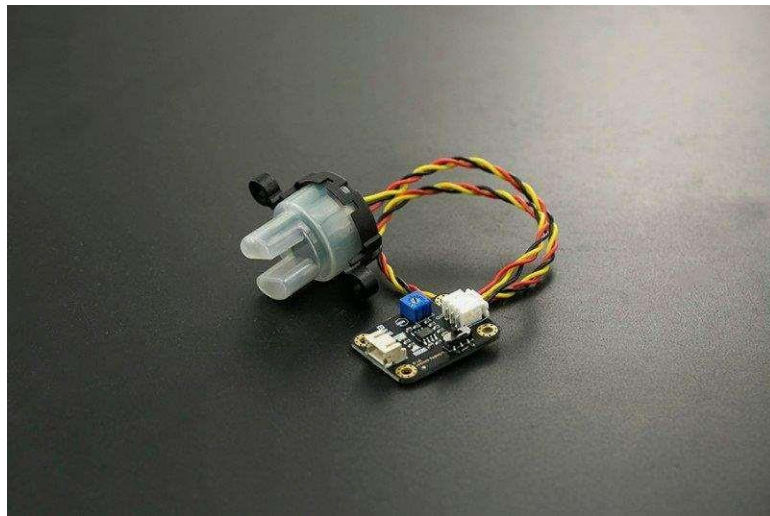


Figure.4.2.Turbidity Sensor

There are many benefits to using a turbidity sensor:

- There are so many different turbidity sensors available to accommodate yneeds.
- They are highly accurate.
- They are easy to use.
- They can be used in a wide variety of environments, for example, they can be fed down a pipe, or they can be handheld, immersing the probe into a sample.
- You can obtain turbidity measurements in different metrics (NTU, FTU, etc.)

Arduino:

A microcontroller board called Arduino UNO is based on the ATmega328P. It contains 6 analogue inputs, a 16 MHz ceramic resonator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button.

It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery. You can experiment with yUNO without being overly concerned that you'll make a mistake; in the worst case, you can replace the chip for a few dollars and start over As displayed in Figure4.3.

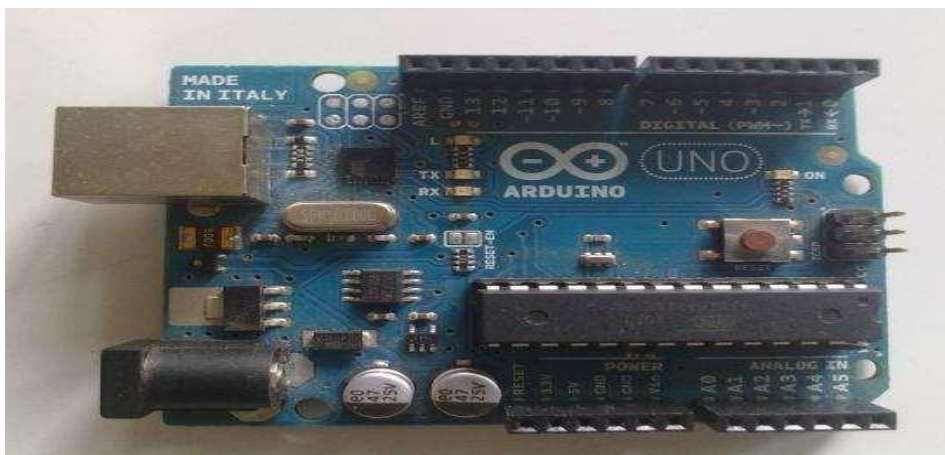


Figure.4.3.Aurduino Board

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicate with software running on ycomputer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. Arduino is a tool for making computers that can sense and control more of the physical world than ydesktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

Water Level Sensor:

The water level sensor is a device that measures the liquid level in a fixed container that is too high or too low. According to the method of measuring the liquid level, it can be divided into two types: contact type and non-contact type. The input type water level transmitter call is a contact measurement, which converts the height of the liquid level into an electrical signal for output. It is currently a widely used water level transmitter.

The working principle of the water level sensor is that when it is put into a certain depth in the liquid to be measured, the pressure on the sensor's front surface is converted into the liquid level height. The calculation formula is $P = \rho \cdot g \cdot H + P_0$, in the formula P is the pressure on the liquid surface of the sensor, ρ is the density of the liquid to be measured, g is the local acceleration of gravity, P_0 is the atmospheric pressure on the liquid surface, and H is the depth at which the sensor drops into the liquid.

The level sensor is a device designed to monitor and measure liquid (and sometimes solid) levels. When the liquid level is detected, the sensor converts the sensed data into an electrical signal. It is displayed in Figure 4.4.



Figure.4.4. Water level sensor

LCD:

Scratch pad displays and other smaller PCs use LCD (Liquid Crystal Display) technology. LCDs allow presentations to be far more slim than technology for cathode beam tubes, similar to technology for light-producing diode (LED) and gas-plasma (CRT). LCD displays use a lot less power than LED and gas displays since they operate by the principle of obstructing light rather than emitting it.

For a dynamic framework exhibition, an LCD is either constructed using an unconnected lattice or a showcase network. The flexible LCD is sometimes referred to as a thin film transistor (TFT) display. At each intersection of the network of pixels on the uninvolved LCD lattice, a matrix of conductors is present. A current is sent to control by two conductors on the lattice.

Every pixel crossing point in a functional framework has a transistor, which uses less current to control pixel luminance. Certain independent network LCDs have double filtering, which means that they inspect the matrix with current twice while the initial innovation only swept it once. Nonetheless, dynamic lattice is still a superior innovation.

A 16x2 LCD display is a crucial component that is frequently used in many devices and circuits. It is popular to use these modules with more than seven sections and other multi-fragment LEDs. The grounds for this are that LCDs are reasonably priced, efficiently programmed, and do not have any limitations on the

display of unusual and even custom characters (unlike in the seven fragments), movements, etc. It is presented in Figure 4.5.



Figure 4.5. LCD display

A 16x2 LCD indicates that 16 characters can be displayed on each of its two lines. In this LCD, each character is displayed as a lattice of 5x7 pixels. This LCD has two registers, specifically Command and Data.

The order register stores the instructions delivered to the Display. An order is a command that instructs LCD to carry out a predetermined task, such as introducing it, clearing its screen, positioning the cursor, managing presentation, and so forth. The information that will be displayed on the LCD will be stored in the information register. The data is the ASCII incentive for the character to appear on the LCD.

The LCD can recognize two different signal types: data signals and control signals. As shown in Figure 4.6. These signals are recognized by the LCD module based on the RS pin condition. Data can now also be read from the LCD display by raising the R/W pin. The LCD display reads and executes data at the falling edge of the pulse after the E pin has been pulsed; this is also true in the transmission scenario.

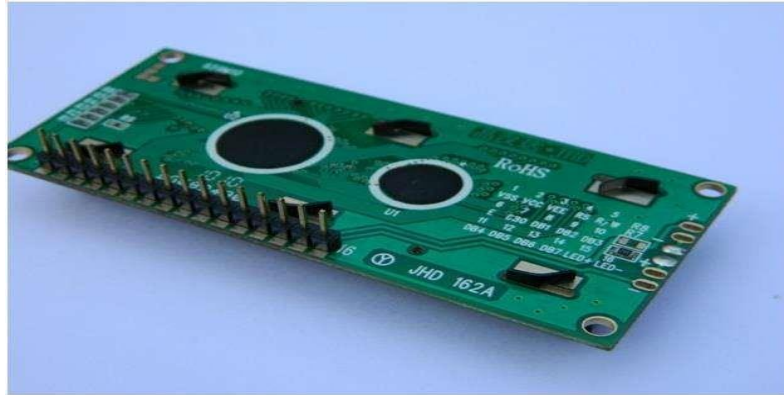


Figure.4.6.LCD

Data/Signals/Execution of LCD

That was all about the hardware and the signals, though. We'll now discuss data, signals, and execution.

The LCD can recognise two different signal types: data signals and control signals. These signals are recognised by the LCD module based on the RS pin condition. Data can now also be read from the LCD display by raising the R/W pin. The LCD 39 display reads and executes data at the falling edge of the pulse after the E pin has been pulsed; this is also true in the transmission scenario. The LCD display places a character or issues a command in 39–43 S. Apart for clearing the display and looking for the cursor's home point, it takes 1.53 to 1.64 milliseconds.

Any attempt to communicate data prior to this window could prevent some devices from reading or processing the current data. Some devices reduce their speed by storing incoming data in a few temporary registers.

For LCD panels, there are two RAMs: DDRAM and CGRAM. The location where the character would appear in the ASCII chart is stored in DDRAM. Each point on the LCD panel is represented by one DDRAM byte.

The LCD controller reads the data from the DDRAM and displays it on the LCD screen. Users can create their own unique characters with CGRAM. The first 16

ASCII characters are reserved for users as address space. Users can easily display their custom characters on the LCD screen after CGRAM has been set up to display characters. The pins are shown in Figure 4.7.

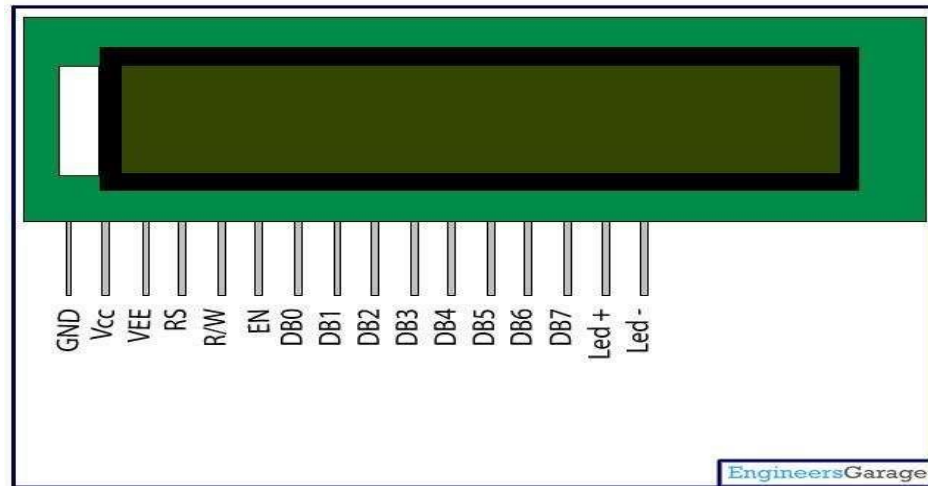


Figure.4.7.LCD pin discription

Light Emitting Diodes:

A semiconductor light source with two leads is the light emitting diode. Nicholas Holonyak, who was employed by General Electric, developed the concept of the lightemitting diode in 1962. The LED is a unique kind of diode with electrical properties that are comparable to those of a PN junction diode.

Hence, the LED permits electricity to flow in one direction while blocking it in the other. The LED takes up a very small space, less than 1 mm². LEDs are employed in a variety of electrical and electronic projects. The operation of the LED and its uses will be covered in this article.

A p-n junction diode serves as the light-emitting diode. It is a unique form of semiconductor and a particularly doped diode. A light emitting diode is one that produces light when it is forward biased.



Figure.4.8.LED

commonly refer to a diode as a light-emitting diode which is represented in Figure.4.8. The electrons and holes are flowing quickly across the junction when the diode is forward biased, and they are continually merging and driving one another out of the way. It combines with the holes just as the electrons are switching from n-type to p-type silicon, then vanishes. As a result, the entire atom becomes more stable and receives a modest energy boost in the form of a photon, a tiny packet of light.

In essence, a light-emitting diode (LED) is a pn junction diode. Incoherent light is produced when carriers are injected through a junction that is forward-biased. A heavily doped n and p junction is used to create the majority of commercial LEDs.

A crucial class of industrial LEDs that can be clearly distinguished. Ternary composites with the intention of alloying the Gas and GaP denoted by $\text{GaAs}_{1-y}\text{Py}_y$. A quarternary (4-component) III-V compound with an instantaneous band crevice is InGaAlP in this instance. A homojunction is a type of LED that uses two semiconductors with different levels of doping but the same base material. They are referred to as heterostructure devices when they are recognised using various bandgap materials. A heterostructure LED is brighter than a homoJunction LED.

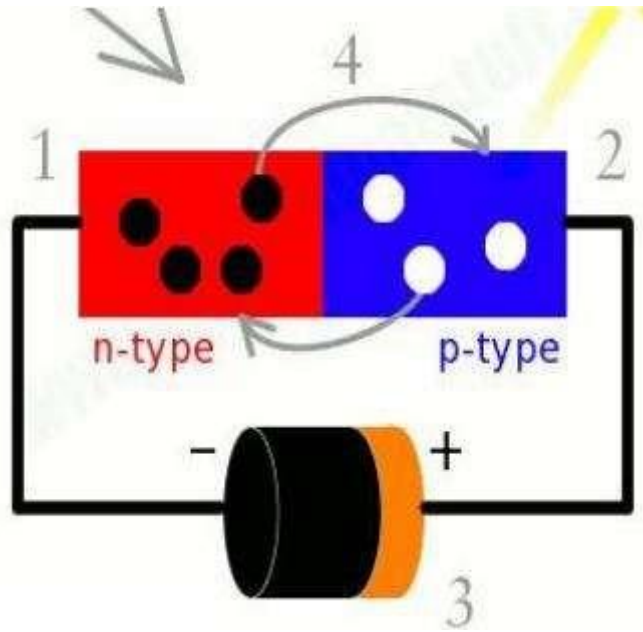


Figure.4.9.Working of LED

The LED structure plays a crucial role in the light emission from the LED surface. Figure 4.9 says The arrangement of the LEDs ensures that the bulk of recombinations occur by the following two methods at first glance. • By increasing the substrate's doping level, which causes more free minority charge transporters to rise to the surface, mix, and emit light there.

By expanding the dissemination length $L = \sqrt{D\tau}$, where D is the dispersion coefficient and τ is the bearer life time. In any case, when expanded past a basic length there is a possibility of re-retention of the photons into the gadget.

The typical base for an LED is an n-sort substrate with a terminal attached to the p-sort layer stored on it. P-sort substrates do exist, despite being less basic. Many commercial LEDs, especially GaN/InGaN, also use sapphire substrate. Driving productivity: The outside quantum proficiency second is a crucial LED metric. It gauges how effectively electrical energy is converted into transmitted optical energy. Its distinctive feature is the isolation of the light production from the electrical information power

4.2 SOFTWARE DESCRIPTION

Arduino IDE

Arduino IDE where IDE stands for Integrated Development Environment – An official software introduced by Arduino.cc, that is mainly used for writing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go.

Introduction to Arduino IDE

- Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module.
- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
- It is easily available for operating systems like MAC, Windows, and Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.
- A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.
- Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.
- The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. 47

- The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.
- This environment supports both C and C++ languages.



Figure.4.10.Arduino IDE

One of the advantages of using the Arduino IDE is its versatility. It supports a wide range of Arduino boards and shields, and it can be used on different operating systems such as Windows, Mac OS, and Linux.

It also has a large and active community of users who share their knowledge, code, and projects As shown in Figure 4.10.Overall, the Arduino IDE is a powerful and easy-to-use tool for programming Arduino boards, making it an ideal choice for hobbyists, students, and professionals alike.

4.3.METHODOLOGY OF THE MODEL:

In this, present the theory on real time monitoring of water quality in IoT environment. The overall block diagram of the proposed method is explained. Each and every block of the system is explained in detail.

In this proposed block diagram the Figure 4.11 consist of several sensors (pH, turbidity,level) is connected to core controller. The core controller are accessing the sensor values and processing them to transfer the data through internet. Arduinio is used as a core controller.

4.4 ARCHITECTURE DESIGN OF PROPOSED SYSTEM:

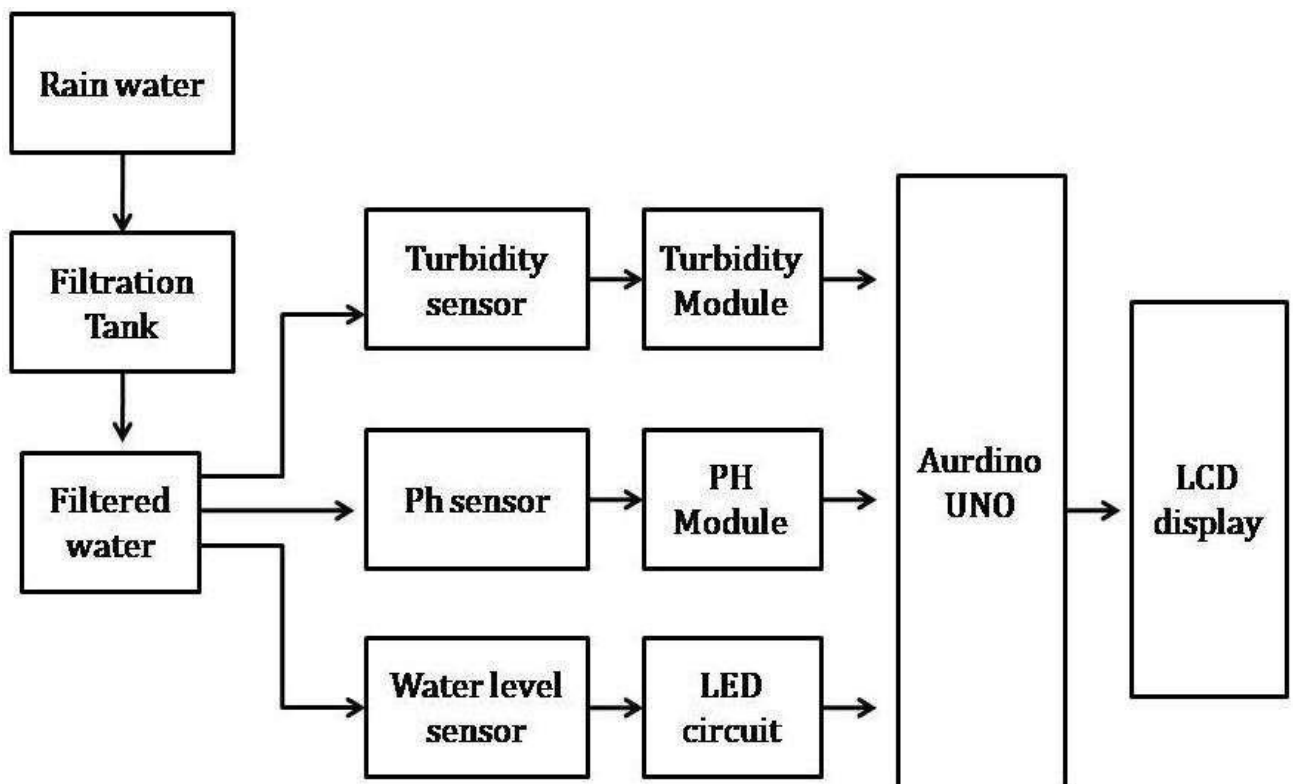


Figure.4.11 Architecture

4.5.LIST OF MODULES

proposed system is made up of these following.

Module 1: Water filtration

Module 2: Filtered water

Module 3: Water Level

Module 4: Water PH level

Module 5: Water Turbidity

4.5.1.MODULE 1

This is the first section of the water management plant, the water enters into the filtration tank. it consists of five layers of filtration elements like sand, rock, gravels, coal powder and cloth sheets. The filtration elements are placed between the filtration cloth for pure filtration as displayed in Figure 4.12.

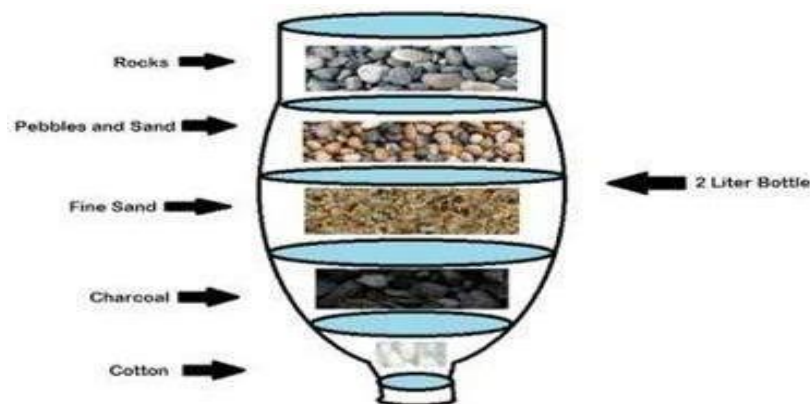


Figure.4.12.Filtration tank

4.5.2.MODULE 2

After the water from the filtration tank then the water reaches another tank which is shown in Figure 4.13, where it stores the filtered water. From here onwards the water will be used on various uses based on the results get.

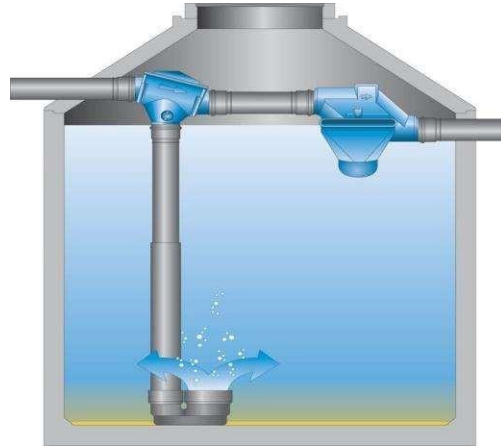


Figure.4.13.water tank

4.5.3.MODULE 3

For measuring the water level ,the water level sensor is used. If the Figure3.8 is closely observed there is a red scale type device ,it is the water level sensor.It tells whether the tank is full or not or at which level the water is filled in the tank.In this paper it is used to measure the filtered water level As shown in Figure 4.14.

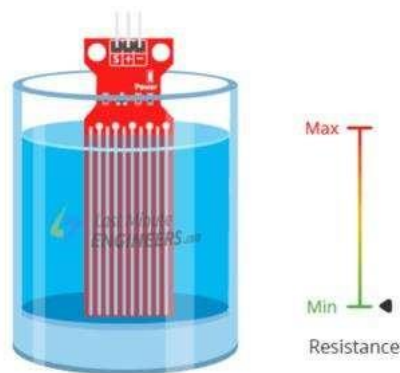


Figure.4.14.water tank with level sensor

4.5.4.MODULE 4

By seeing the pH level of the filtered water, it can be declared that the water can be used either for drinking or other uses. IoT is a tool that detects acidity ranges in a selection of drinks. A solution's pH is a degree of the acidity or alkalinity of that answer. The pH scale is a logarithmic scale that runs from zero to fourteen with an interval factor of seven.

The whole design of the system is based mainly on IOT which is a newly introduced concept in the world of development. There are basically two parts included, the first one is hardware & the second one is software. The hardware part has sensors which help to measure the real-time values, another one is an Arduino ATmega328 which converts the analog values to digital ones, & LCD shows the display output from sensors.

The PCB is designed at the first level of construction and components and sensors are mounted on it. BLYNK app is installed in the Android version to see the output. When the system gets started, DC current is given to the kit and Arduino. The parameters of water are tested one by one and their results are given to the LCD display. Thus, like this, when the kit is located on any specific water body.

4.5.5.MODULE 5

Continuous turbidity sensors are used to monitor and measure the turbidity of water in real-time. These sensors consist of a light source and a detector. The light source illuminates the water, and the detector measures the amount of light that is scattered by the suspended particles.

The sensor then converts the scattered light into an electrical signal that is processed to provide a turbidity reading. Continuous turbidity sensors are designed to provide reliable and accurate measurements over time, and they can be used to monitor changes in turbidity levels, detect pollution events, and ensure the effectiveness of water treatment processes.

solid particles that float or drift in the water. For suspended particles to be considered SS, they must be 2microns or larger, with anything smaller being considered a Dissolved Solid (DS). High turbidity water appears cloudy due to SS making the water darker. Depending upon the Values shown in Table 4.1.

Turbidity NTU	NEMS Standards	RiverWatch
ISO	7027	7027
Resolution	0.1	0.01
Accuracy	± 0.3	± 0.3
Range		1-1000

Table.4.1.Turbidity values

4.6 PROJECT MANAGEMENT PLAN:

A project management plan is an essential component of any project, including the design and implementation water monitoring and filtering. The plan outlines the key activities, timelines, and resources required to successfully complete the project. Below is a sample project management plan for this project:

- **Project Objectives:** The primary objectives of the project are to design, build, and test an water monitoring and water filtering that can detect and it display values to owners and providing real-time updates to emergency responders.
- **Project Timeline:** The project timeline is broken down into the following phases:

- **Planning Phase** (1 week): During this phase, the project team will define the project objectives, scope, and requirements. They will also develop a project management plan, identify project risks and mitigation strategies, and establish a communication plan.
- **Design Phase** (3 weeks): During this phase, the project team will design the hardware and software components of the robot.
- **Implementation Phase** (5 weeks): During this phase, the project team will build and assemble the robot, program the microcontroller and connections of hardware will be done.
- **Testing Phase** (2 weeks): During this phase, the project team will test the functionality and performance in a controlled environment.
- **Deployment Phase** (2 weeks): During this phase, the project team will deploy the robot in a real-world environment and test its functionality in a real world scenario.

4.7 Transition's to Operations Plan:

A Transition/Software to Operations Plan is an essential component of any project, including the design and implementation of an IoT-based fire-Figurehting and affected area monitoring robot. It outlines the steps required to transition the system from the development and testing phase to the operational phase. Here is an example of a Transition/Software to Operations Plan for this project:

4.7.1. Development and Testing:

- The system will be developed and tested in a controlled environment to ensure that all components are working correctly and to identify any potential issues or bugs.
- The testing process will include functional testing, system integration testing, and user acceptance testing.
- The work on fixing any issues identified during testing before proceeding to the next phase.

4.7.2. Documentation:

- Documentation will be created to explain how the system works, including user manuals, technical manuals, and training materials.

4.7.3. Roll-out:

- The system will be gradually rolled out in a phased approach to minimize disruption and ensure that all stakeholders are adequately trained and prepared.
- The roll-out plan will include a detailed schedule, budget, and resource allocation plan.

4.7.4. Maintenance:

- The maintenance plan will include routine maintenance tasks such as hardware replacements and maintenance

4.7.5. Performance Monitoring:

- The system's performance will be continuously monitored to ensure that it is meeting the required performance metrics.

4.8. ADVANTAGES AND APPLICATIONS

4.8.1. Advantages

1. Real-time Analysis of Water Consumption :

IoT-based systems are advanced versions of technology inclusion in the water industry. The solutions are equipped with quality sensor devices that capture accurate information from the assets and transfer it to the user's dashboard in real-time. This benefits the users in massive ways, identifying the water consumption patterns and analysing the judicious use of water in all aspects

2.Reduced Maintenance Costs:

The water industry consists of huge storage tanks and machinery requiring frequent monitoring to avoid bulky maintenances. IoT-based systems enhance

the efficiency of industrial equipment like water collectors, treatment plants, distribution mains, and wastewater recycling centres. Hence, the technology-based functionality helps reduce maintenance costs with automated techniques and scheduled monitoring.

3. Prevention of water diseases.

4. Due to automation it will reduce the time to check the parameters:

IoT strengthens the real-time insight gathering and enables remote monitoring for the water authorities. Even when there is a shortage of staff or anyone is travelling, they can check on their business's performance through an interconnected system, which is well-structured with the help of IoT technology. It provides an accurate response to the industrialists in providing remote valve control, real-time insights on their connected gadgets, and much more.

5. Sustainability:

Sustainability goals are at the center of many retrofit and innovation projects not only in the smart water industry but across any other sector such as energy, construction, logistics, etc. Technologies for smart water use are no longer seen as a source of savings and higher efficiency only, but as the means to reach different situations.

- More convenient, sensed as soon as one is seated in position.
- Low cost and a better approach to be used with existing methods.
- Secure and safety.

4.8.2.Applications

- Water quality testing
- reduce wastage of water
- irrigate landscaping
- wash cars
- launder clothes and
- it can even be purified for human consumption.

CHAPTER-5

RESULTS AND DISCUSSIONS

Experiment results :

Details regarding the experimental findings of the suggested method are provided in this section. With an Arduino board and few sensors, the water monitoring and filtering method has been implemented effectively. The design's various modules communicate effectively without interfering with one another. All requirements and parameters are met during design. Before realizing the hardware, software tools like arduino ide, proload to dump the source code into the microcontroller ,were used to generate the software code.The software code is transferred to aurdino as shown in Figure 5.1.

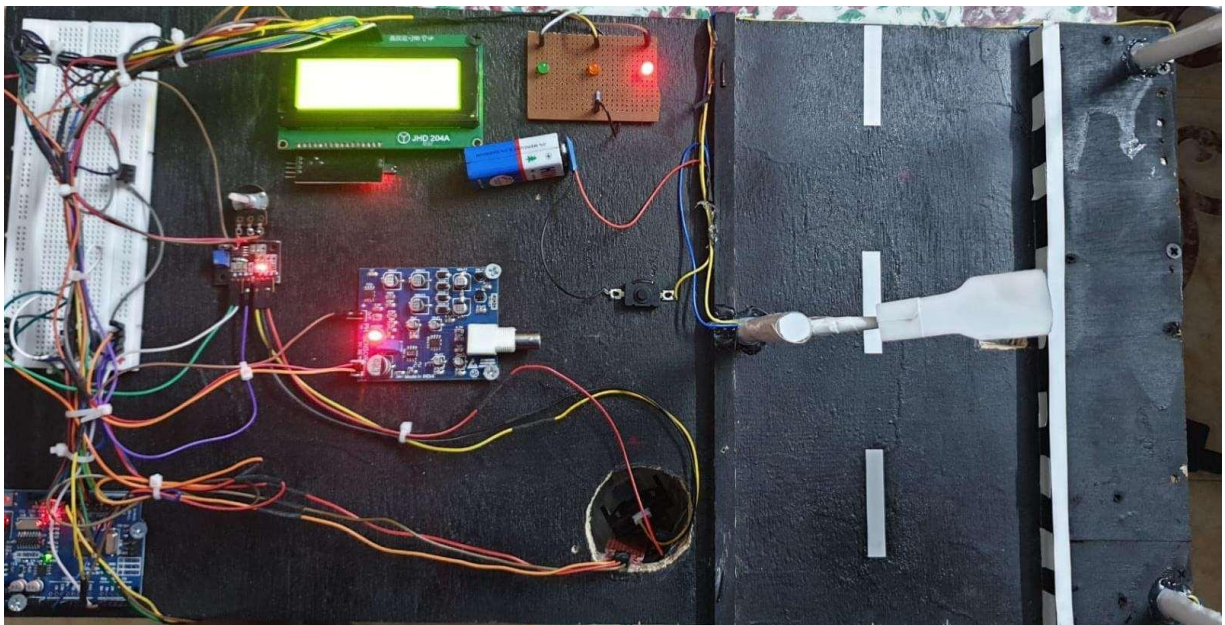


Figure 5.1. Hardware part of project

And after the readings of water quality will be displayed in LCD as shown in Figure.5.2. In the last few years, the water sector has faced significant challenges, in particular, the effort to develop a smart water system in order to improve efficiency and sustainability performance (e.g., social, technical, and

environmental). The developed designations, as well as the analyzed case studies, show that the application of this IOT based water harvesting technology does not only contribute to the future of smart cities in terms of water but also to energy nexus, through adequate smart water planning and management. The values will be displayed from LCD display as shown in Figure.5.2.



Figure.5.2.LCD displaying the water quality

This application will improve the water sustainability and management, as well as the policy of smart cities adequately adapted considering different constraints. The selected techniques and actions depend on the considered threshold, the capital investment, and the availability of techniques and equipment. In addition, these applied strategies must be associated with a worldwide awareness of society to the sustainable planning and management for the best use of available resources. Through the technological innovations, the IOT technology will reduce costs, increase the service quality and optimize the operation of the system. The proposed methodology can also be applied to other water networks contributing to improving system efficiency and sustainability by better management of the water resources.

CHAPTER 6

CONCLUSIONS AND FUTURE SCOPE

6.1 CONCLUSIONS:

Monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage and existing GSM network. The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters. The operation is simple. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on. It has widespread application and extension value. By keeping the embedded devices in the environment for monitoring enables self protection (i.e., smart environment) to the environment. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi.

6.2.FUTURE SCOPE:

The system capacity can be increased to obtain more efficient reliable results. can also add different sensors to calculate the water parameters like conductivity, chemical oxygen demand(COD), oxygen level, ammonia nitrogen, nitrate, and nitrite, and also phosphate.

- In future use IOT concept in this project
- Detecting the more parameters for most secure purpose
- Increase the parameters by addition of multiple sensors
- By interfacing relay controls the supply of water

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