FEYNN LABS

A PROJECT REPORT 3

ON

"WATER QUALITY MONITORING AND DISEASE PREDICTION"

BY- ASHUTOSH MISHRA

ABSTRACT

Due to the massive increase in global mechanical yield, the transition from rural to urban areas, and the excessive exploitation of incoming and ocean resources, a system must be established to ardently test the quality of water made available for drinking in town and city verbal supplies, as well as the waterways, rivulets, and shoreline that surrounds our towns and cities. It is crucial to have access to high-quality water in order to reduce outbreaks of waterborne illness and improve overall quality of life. The major objective of the study was to develop forecasts for illnesses that are spread by water using machine learning algorithms on data on water quality. This task involved collecting awareness of some water quality parameters. Use different sensors to monitor different parameters of water. The entire system has an Arduino that connects sensors to GSM modules to remotely monitor data. You can monitor various water areas in real time. Learn about the design and development of cost-effective real-time water monitoring systems.

Keywords:

IOT- Internet of things,

ML-Machine Learning,

WSN-Wireless Sensor Network,

Sensors.

CHAPTER 1

INTRODUCTION

Water pollution is one of the biggest problems of green globalization. It needs to be monitored to ensure the maximum and safe supply of drinking water. The system contains sensors that continuously monitor the condition of these waters. The monitoring system contains and stores real-time water quality data. Real-time storage and access to data collected by cloud technology. The sensor data can then be displayed on the internet via the WI-FI system. Water is infested with viruses, bacteria, metals, toxins, and other chemicals that cause a variety of water-borne bone diseases. The concept of the IoT extends human-computer and computer-to-computer communication, embedding it in everyday objects and providing identities and capabilities that modify data over the network. A wireless sensor network consists of multiple distributed sensor nodes that can physically collect data and send it to a central base station.

Today, with limited water resources and growing population, water has become an essential resource for humankind. Clean and safe drinking water is humanity's most important resource. Today, most diseases are spread through water and require an online real-time water quality monitoring system. The methods currently used to assess water quality allow water samples to be randomly taken weekly or monthly from various locations and analysed in the laboratory. This approach is not very efficient due to various drawbacks, including: B. Long-term consumption, only a few regional water samples can be measured at the same time. This method also requires manual work to regularly monitor the water quality. These methods are also costly and not efficient enough in large, populous countries such as India and China. Overcoming these shortcomings requires a real-time system that monitors water quality through sensors such as pH, turbidity, and

temperature, and updates these values with cloud services. The system consists of sensors that measure the chemical composition of water. Data from the Event Hub is stored in the Azure Storage Hub in the form of structured data. The data is then streamed to an external service via Stream Hub. Power BI, also a Microsoft platform, is used to display sensor readings in the form of web pages. This document uses the MQTT client broker architecture to transfer data from a microcontroller to an external MQTT broker service. Turbidity measures a large number of suspended particles in invisible water. The higher the turbidity, the higher the risk of diarrhea and cholera. Lowering the turbidity will make the water cleaner. In addition to turbidity, the pH value is also an important indicator of the acidity of drinking water. Temperature sensors measure how hot or cold water is. Another part of this task is to record the outside air temperature near the water storage tank and control heating or cooling depending on the temperature. This part of the dissertation uses machine learning. The system uses previously identified datasets to predict weather conditions and control heating and cooling according to external weather conditions. This fully automates the system without manual intervention. When the turbidity value reaches a predefined threshold, an email alert will be sent to the relevant authorities to notify them of the situation and force them to take immediate action.

1.1 DOMAIN INTRODUCTION

The term "Internet of Things" (IOT) refers to actual things (or groups of such things) that are equipped with sensors, processing power, programming, and other innovations and may communicate with other devices and frameworks over the Internet or other communication networks. The field has advanced as a result of the convergence of numerous developments, like omnipresent figuring, wearable sensors, increasingly powerful implanted frameworks, and AI. Traditional fields including implanted

frameworks, remote sensor organisations, control frameworks, and mechanisation enable the Internet of Things (counting home and building computerization).

IOT technology is most closely associated in the consumer market with products that support the concept of the "smart home," such as lighting devices, indoor regulators, home security frameworks and cameras, and other home machines that can be controlled by devices related to that environment, such as cell phones and smart speakers. Medical services can also make use of the Internet of Things. Concerns concerning the development of IOT and the risks associated with product development, particularly in the areas of safety and security, are numerous. As a result, business and the governmentare starting to address these issues, including enhancing local and global governance institutions.

1.2 PROBLEM DEFINITION

The nature of water available to humans is fundamentally diminished by the significant increase in total mechanical power common to swimmers in large cities and the overfishing of the ocean and marine resources. As such, the equipment needs to be installed and enthusiastically tested. Drinkable water and cities, as well as the streams, streams and coastlines that make up our cities and urban communities, represent supply. The availability of good quality water is the basis for preventing the development of water-borne diseases and for the overall work towards personal well-being. The most balanced consideration was to apply AI techniques to water quality data to infer water-borne diseases. This work involved collecting impressions of some water quality limits. The World Economic Forum classifies drinking water shortages as one of the global dangers that cause about 200 children to bite dust every day. Drinking only dangerous water kills about 3.4 million people each year. Despite advances in innovation, there is a lack of appropriate water quality measures to assess the quality of drinking water. By focusing

on the above issues, this paper proposes a minimal-cost water quality monitoring framework that takes advantage of new advances. This helps save rural people from various dangerous infections such as fluorosis and astigmatism.

1.3 OBJECTIVES

The major objective of this work was to use machine learning techniques to forecast water-borne diseases using data on water quality. This work included leveraging the Internet of Things to gather observations of various water quality metrics (IOT). Detailed information with observations of each necessary parameter. With the gathered data, gradient boosting classifiers were developed and put to the test. For cross-validation and holdout data, the results' accuracy ranged from 0.92 to 0.95, respectively. Following training, the model began to predict events based on the raw data. The push bullet service was used to send a notice of the anticipated illness. As a result, this study provided evidence that water quality measures could be helpful in the early detection of water-borne diseases.

1.4 SCOPE OF THE PROJECT

1. Integrating this technology into state and federal work processes enables government officials to respond quickly and improve quality of life in both rural and urban areas.
2. You can add a mobile GPRS module to your system to allow data to be sent over 3G or 4G channels as most Indian villages do not have a WIFI connection.
3. Increasing the number of quality sensors that can identify additional chemical and physical factors that affect water quality will improve insights and increase the effectiveness of the system.

4. Future scope of this project will include environmental monitoring, drinking water quality, wastewater treatment, disinfection and more. In addition, this technique can be used in many industrial processes.

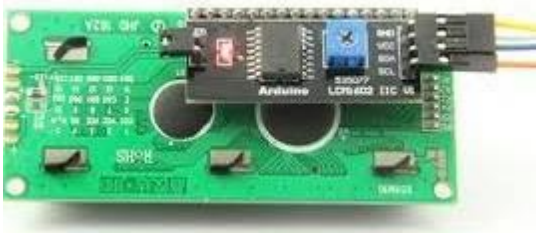
CHAPTER 2

REQUIREMENT ANALYSIS

2.1 FUNCTIONAL REQUIREMENTS

16X2 I2C LCD Display

In order to reduce circuit connections complexity, we are using I2C interface for 16x2 LCD. It is used here to display status information of the project such as sensor readings.



16*2 12C LCD Display

pH Sensor Module

Figure: PH Sensor Module

The PH sensor package with PH electrode probe is compatible with Arduino. pH represents hydrogen power, which is an estimate of the fixation of hydrogen particles in the body. It is used in water quality inspections and aquaculture. The overall pH scale ranges from 1 to 14, with 7 being considered bias-free. A pH below 7 is considered acidic and a more pronounced pH arrangement than 7 is mandatory or basic. The PH cathode has a single chamber that can be directly connected to the information port of any pH device with a pH meter, controller, or BNC input connector. The pH terminal test is accurate and robust and can provide virtually instant measurements. This kit is intended for Arduino controllers and contains basic, informative, realistic associations and elements. It features an LED that acts as a power indicator, a BNC connector, and a PH 2.0sensor interface. To do this, simply connect the pH sensor to the BND connector and the PH 2.0 interface to the simple information port on your Arduino controller.

5V Regulator Board

Figure: 5V Regulator Board

We are using 5V Voltage Regulator board to provide supply for all the peripherals. We are using 12V 2A DC Adapter as input to the regulator board.

Power Supply

The Arduino Uno power supply can be performed with the help of a USB cable or an out of doors power supply. The out of doors power additives specially embody AC to DC adapter otherwise a battery. The adapter can be related to the Arduino Uno through manner of approach of plugging into the power jack of the Arduino board. Similarly, the battery leads can be related to the Vin pin and the GND pin of the POWER connector. The endorsed voltage range is probably 7 volts to 12 volts.

Input & Output

The Arduino Uno's 14 digital pins can be used as inputs and outputs using functions such as pinMode (), digitalWrite (), and Digital Read ().

Pin 1 (TX) and Pin 0 (RX) (serial):

Pin 2 and Pin 3 (external interrupt):

You can connect an external pin to enable low value interrupts, which are changes in value.

Pins 3, 5, 6, 9, 10, and 11 (PWM):

This pin provides 8-bit PWM o / p via the analogWrite () function.

SPI pin (Pin-10 (SS), Pin-11 (MOSI), Pin-12 (MISO), Pin-13 (SCK):

These pins are provided by the basic hardware and maintain SPI communication even if it is not currently in the Arduino language.

Pin 13 (LED):

The built-in LED can be connected to pin 13 (digital pin). As a high value pin, the light emitting diode is active whenever the pin is LOW.

Pin 4 (SDA) and Pin 5 (SCL) (I2C):

Supports TWI communication using the Wire library.

AREF (reference voltage):

The reference voltage is for analog I / ps using analogReference ().

DOMAIN REQUIREMENTS

IOT

The Internet of Things (IOT) alludes to actual devices (or gatherings of such articles) that are provided with sensors, coping with power, programming, and precise upgrades and may communicate with precise gadgets and frameworks over the Internet or unique correspondence organizations.

As a give up end result of the juncture of several upgrades, like pervasive figuring, product sensors, step by step strong inserted frameworks, and AI, the field has advanced. The Internet of Things is empowered thru manner of manner of ordinary areas, for example, implanted frameworks, a long way off sensor organizations, manipulate frameworks, and computerization (counting home and building mechanization). In the consumer market, IOT innovation is most firmly related with devices that help the idea of the "clever home," like lighting apparatuses, indoor regulators, home protection frameworks and cameras, and unique home machines that can be limited thru manner of manner of gadgets related to that natural system, for example, molecular phones and savvy speakers. The Internet of Things can likewise be carried out in scientific services.

There are several problems about the dangers withinside the development of IOT upgrades and devices, particularly withinside the location of protection and protection, and therefore, organization and administrative moves to address the ones problems have started, which incorporates the improvement of worldwide and nearby principles, rules, and administrative systems.

MACHINE LEARNING

AI (ML) is a study of PC computation that can be consistently further processed through the use of experience and information. It is considered part of artificial reasoning. In AI calculations, test information is used to create a model called preparation information, which makes predictions and decisions without adjusting it independently. AI calculations are used in a variety of applications such as medicine, email triage, discourse confirmation, and PC vision. In these applications, encouraging periodic calculations to perform the required tasks can be tedious or impractical. A subset of AI is inextricably linked to computational insights, including the use of personal computers to meet expectations. However, not all AI is measurable learning. A survey of the numerical rationalization process conveys technologies, hypotheses, and applications in the field ofAI. Information mining is an interrelated field of study focused on exploratory research of information through independent learning. Some implementations of AI use informationand nervous tissue that mimic how the natural cerebrum works. In that business application, AI is also known as predictive testing.

GRADIENT BOOSTING ALGORITHM

Angle assisting calculation is one of the maximum astounding calculations withinside the subject of AI. As we understand that the mistakes in AI calculations are notably ordered into classifications i.e., Bias Error and Variance Error. As perspective supporting is one of the assisting calculations its miles applied to restriction predisposition mistake of the model.

Not in any respect like, Ad assisting calculation, the bottom assessor withinside the perspective supporting calculation can`t be referenced with the aid of using us. The base assessor for the Gradient Boost calculation is constant and i.e., Decision Stump. Like, AdaBoost, we are able to track the assessor of the perspective assisting calculation. In any

case, at the off danger that we do not specify the really well worth of assessor, the default really well worth of assessor for this calculation is 100. Angle assisting calculation may be applied for looking forward to regular goal variable (as a Regressor) but similarly unmitigated goal variable (as a Classifier). At the factor whilst its miles applied as a regressor, the price paintings are Mean Square Error (MSE) and whilst its miles applied as a classifier then the price paintings is Log misfortune.

HARDWARE AND SOFTWARE REQUIREMENTS

Required Software:

- Embedded CPP Code
- Arduino IDE (Compiler

Required Hardware:

- Arduino Uno.
- I2C 16x2 LCD Display
- NodeMCU (ESP8266) Board
- pH Sensor Module
- Regulated Power Supply
- 12V 2A DC Adapter

CHAPTER

DESIGN / OVERALL SYSTEM ARCHITECTURE

DESIGN GOALS

The layout purpose of the assignment is to put into effect and offer easy but green gadget to decide nice of water and additionally to are expecting the illnesses if occurs. Considering the prevailing water issues and trouble in figuring out reasons of infection prevailing. The purpose is to layout a gadget that determines nice of water our bodies and analyses how appropriate the water is for exclusive functions. This is performed withthe aid of using growing a `Water Quality Monitoring System`; a gadget is advanced to degree diverse parameters of water together with Turbidity, Total Dissolved Solids (TDS),pH and Temperature and those values are in comparison to best required variety of valuesfor functions like drinking, vegetation, irrigation, aquatic existence and the extent of infection is determined.

Also, we are expecting the infection of the water with the aid of using checking the water in exclusive regions and we gather that water samples to affirm if any disorder is there or not.

SYSTEM ARCHITECTURE

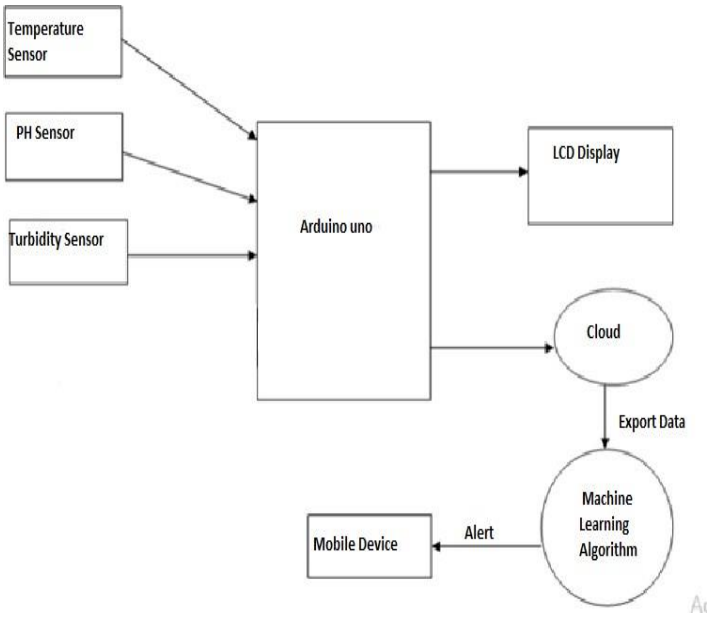


FIGURE SYSTEM ARCHITECTURE

Temperature sensors, pH sensors, turbidity sensors, and continuous analysis of water quality are all part of the proposed water quality monitoring system for disease prediction. All sensors are connected to a central microcontroller (NodeMCU or Arduino) responsible for acquiring sensor data. The collected information is stored on the cloud server. It also

appears on the scroll display linked to the system for visual clues. For disease prediction tasks, the data is exported from cloud storage and sent to a machine learning classifier. We trained a machine learning classifier using secondary data on water quality indicators. Finally, the predicted illness is delivered to the affected mobile device via push notifications.

DATA FLOW

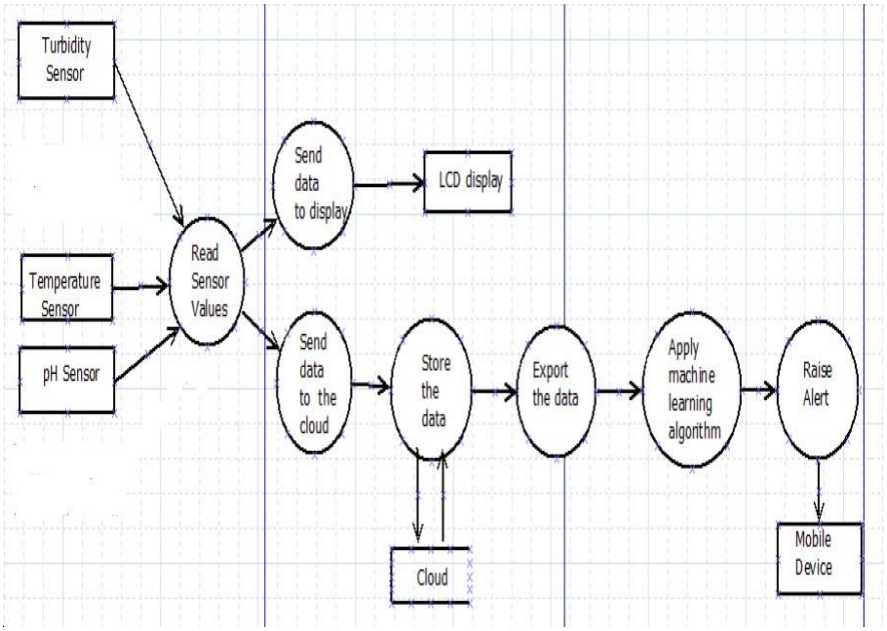


FIGURE DATA FLOW DIAGRAM

The figure above shows the flow of data through a water quality monitoring (WQMDP) system for disease prediction. First, it collects all three sensor values: turbidity, TDS, temperature, pH, and conductivity. The microcontroller then transfers these values to the cloud server and LCD display for further processing. Cloud servers store and process data, triggering alerts about potentially widespread illnesses.

SEQUENCE DIAGRAM

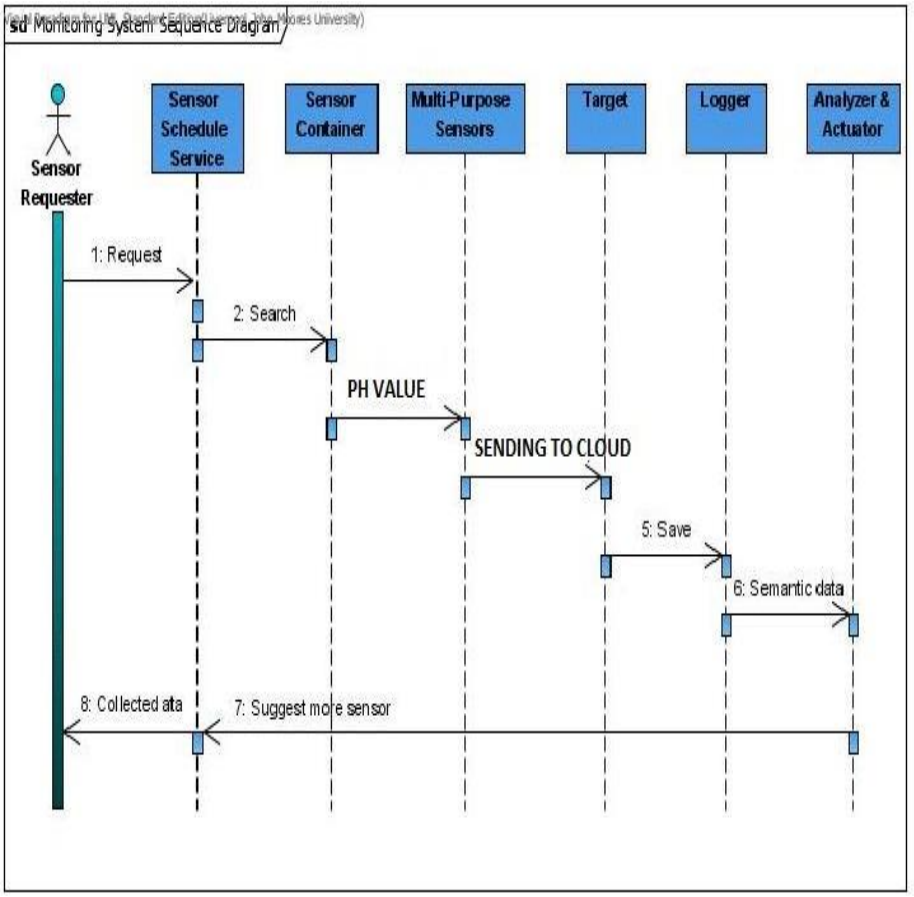


FIGURE SEQUENCE DIAGRAM

CLASS DIAGRAM

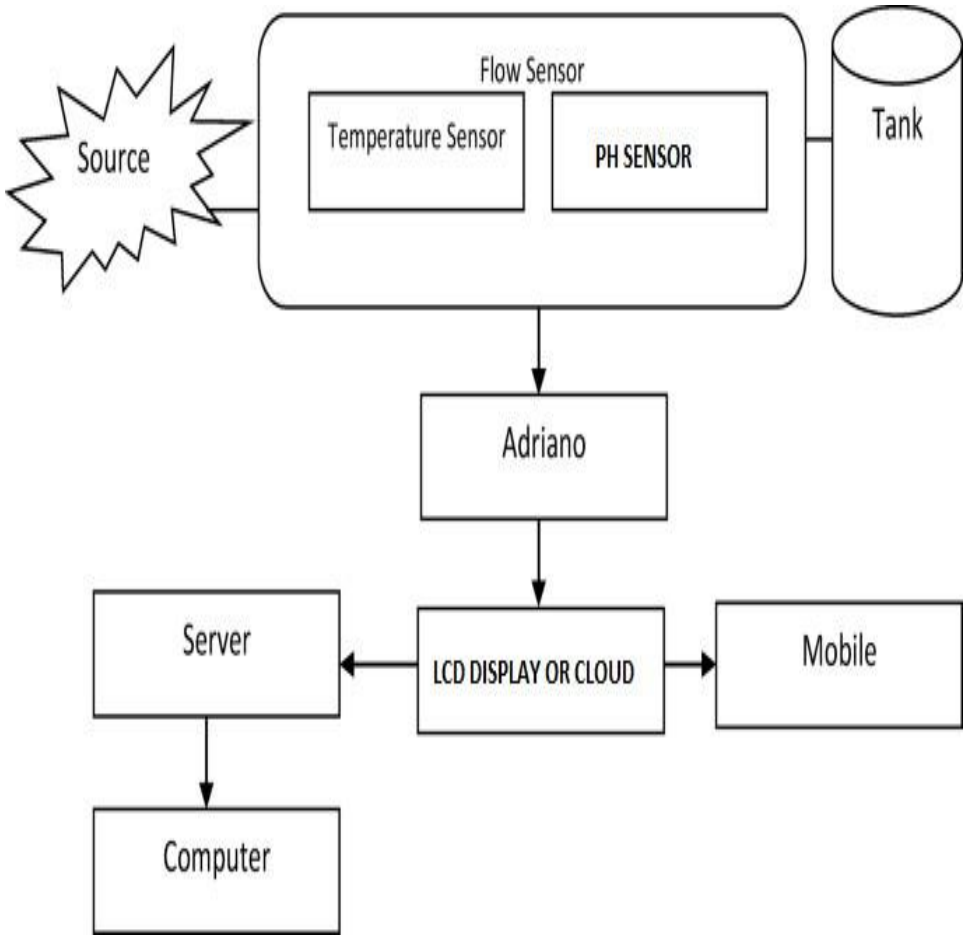


FIGURE CLASS DIAGRAM.

STEPS:

1. In First step the source of water and tank and flow of water through two sensors.
2. The two sensors that are temperature sensor and Ph sensor. To predict PH value of water and disease prediction of water.
3. The whole project deals with Arduino uno where all data is executed in UNO.
4. The predicated value is displayed on 16*2 LCD display.
5. And it is sent to cloud storage and can be accessed in mobile and computer.

CHAPTER

IMPLEMENTATION

STRATEGY

This paper reviews the approach of IOT and Machine learning algorithm Gradient boost Algorithm. So, we can check the temperature of water or temperature of nature and check the PH value of water and we predict water borne diseases.

IOT

The Internet of Things (IOT) is a highly automated and analytical system that uses networks, sensors, big data, and artificial intelligence to create a comprehensive system of products or services. Applying these systems to any industry or system improves visibility, control, and performance. IoT devices can find applications in a variety of industries due to their unique versatility and ability to work in any environment. Use smart devices and advanced enabling technology to improve data collection, automation, operations and more. This course gives a complete overview of the Internet of Things. Here are some basic ideas for the Internet of Things (IOT) needed to use and develop an IOT system.

IOT KEY FEAUTRES

- AI – IOT effectively makes everything “smart”. That means using data acquisition, artificial intelligence algorithms, and networks to improve every aspect of life. Simply add a sensor to your fridge or cupboard to detect the lack of milk or your favorite cereal and order from your favorite grocery store.
- Connectivity – As new network technologies, especially IoT networks, are deployed, the network will be completely disconnected from major carriers. Networks can be built on a much smaller and cheaper scale while still functioning. The Internet of Things (IOT) develops these small networks between system devices.
- Sensors – Without sensors, the Internet of Things loses its uniqueness. They act as definition tools, transforming the Internet of Things from a passive network of devices into an active system that can be integrated into the real world.
- Active involvement – dominates today's interactions with connected technologies. The Internet of Things (IOT) heralds a new era of active interaction with content, products and services.

IOT ADVANTAGES

- The latest improved customer engagement analysis includes blind spots and critical accuracy issues, and engagement remains passive as described above. This has been radically changed by the internet of things, building richer and more effective relationships with viewers.
- Technology optimization the same technology and data that enhances the consumer experience will increase device usage and accelerate technology advancement. The internet of things (IOT) opens up a world of critical functional and field data.

- IOT reduces waste and identifies areas for improvement. While current analytics provide only superficial insights, IOTs provide real-time data that leads to more efficient resource management.
- improved data collection the latest data collection is limited and designed for passive use.

DISADVANTAGES

- The internet of things (IOT) provides a networked ecosystem of always-on devices. Despite all the safety measures, this technique provides little control. As a result, users are vulnerable to many types of attackers.
- privacy advanced IOT allows you to collect large amounts of personal data in detail without user intervention.
- with so many technologies and many new support technologies, some people find the development, implementation, and maintenance of iot systems complicated.
- many people are concerned that IoT systems can easily interact with other systems. They are afraid to end up with multiple competing or closed systems.

OUTPUT SNAPSHOTS

Water Quality monitoring and Disease Prediction

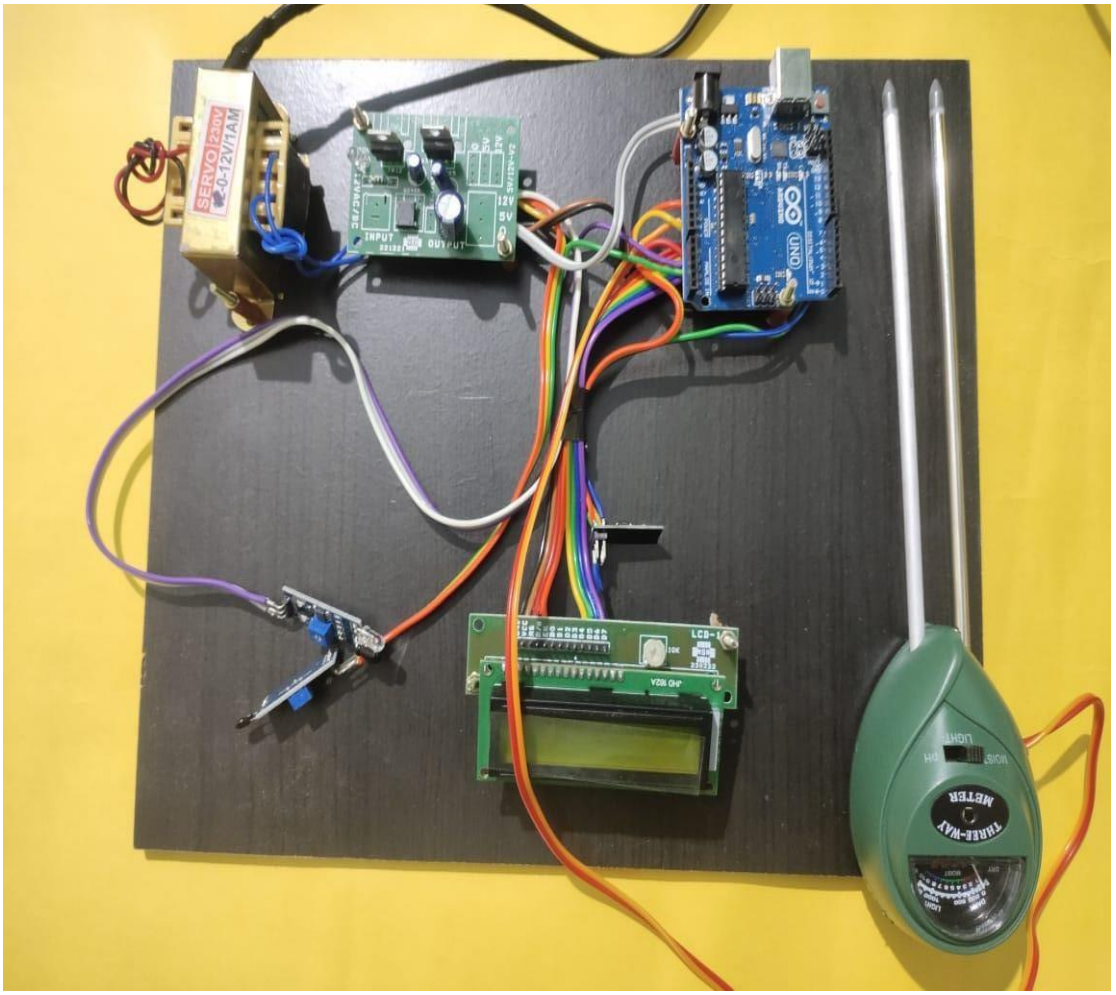


FIGURE Water Quality monitoring and disease prediction

Checking Turbidity of water.

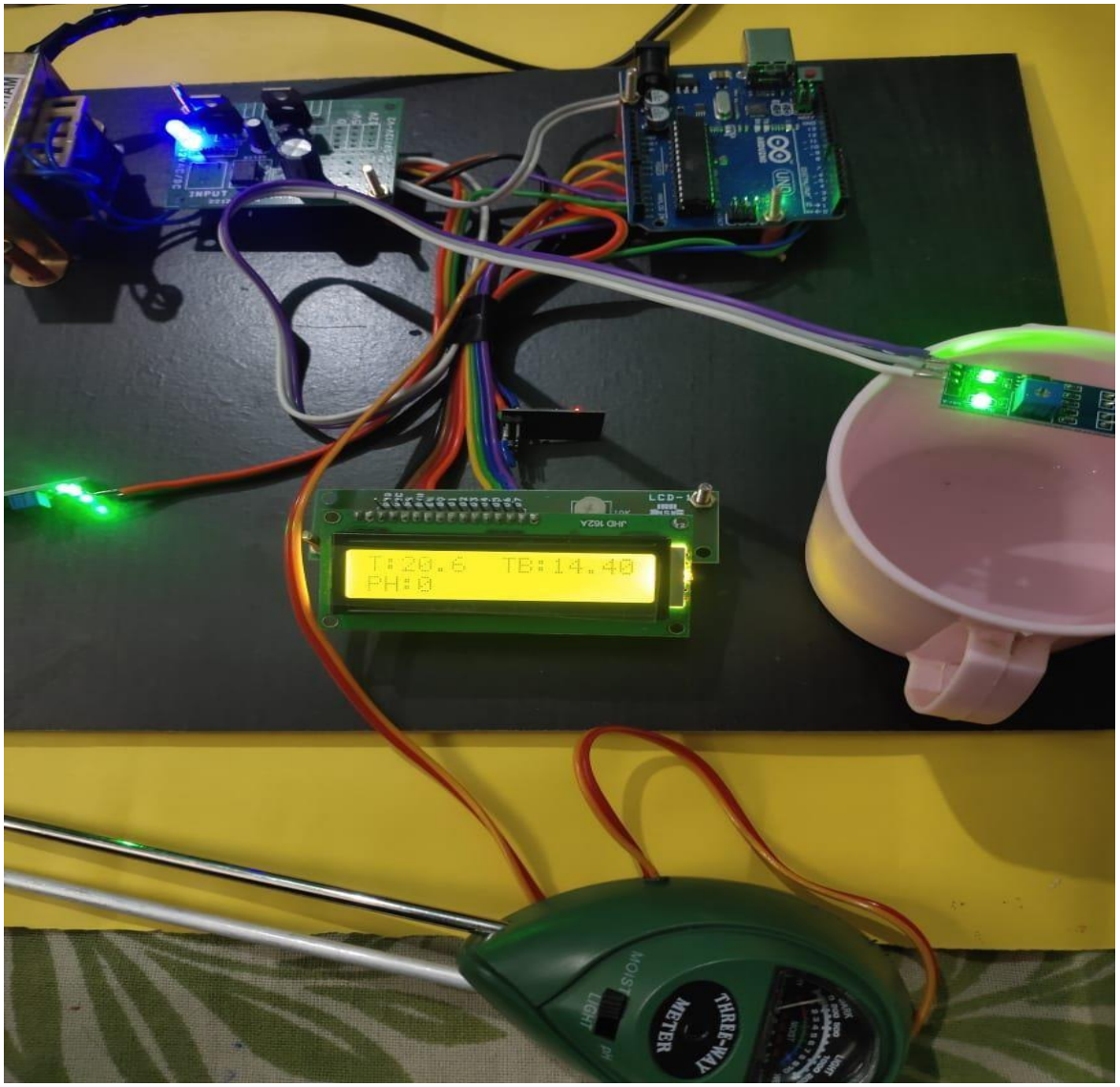


FIGURE Checking Turbidity of water

Checking Turbidity values in cloud / mobile

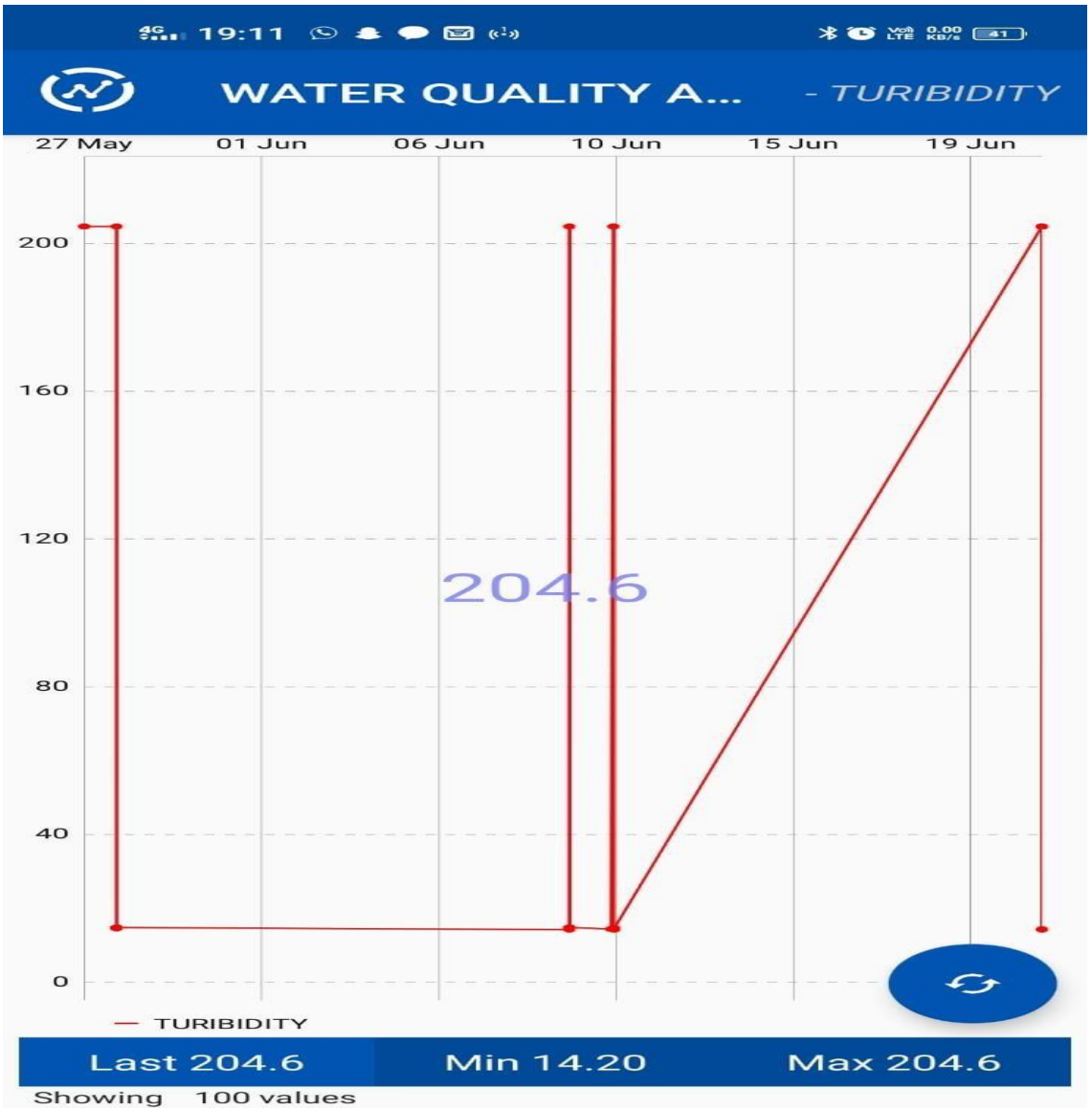


FIGURE checking Turbidity values in cloud/ mobile

Checking Temperature using Temperature sensor

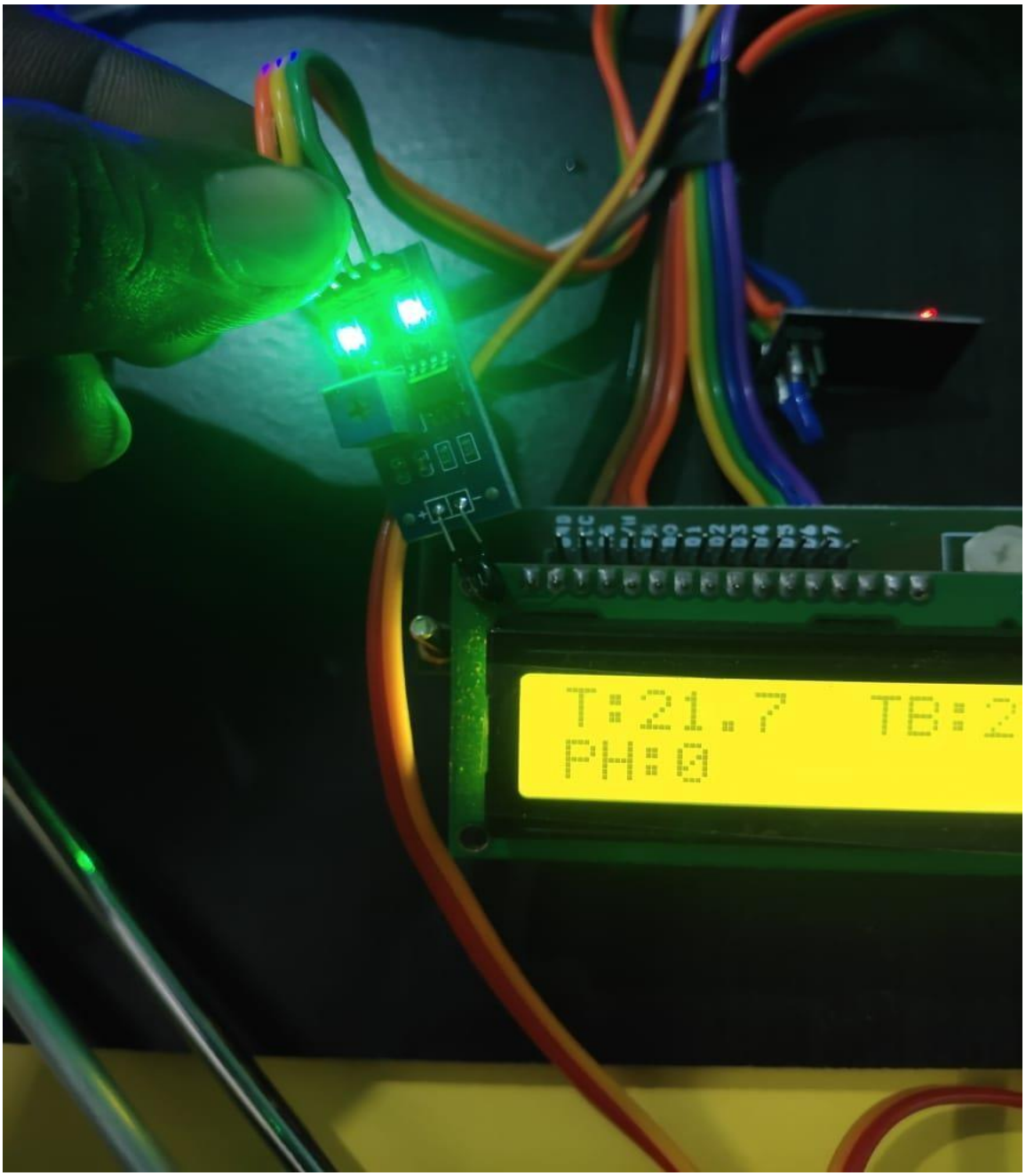


FIGURE Checking Temperature using Temperature sensor

Temperature values in cloud storage/ Mobile.

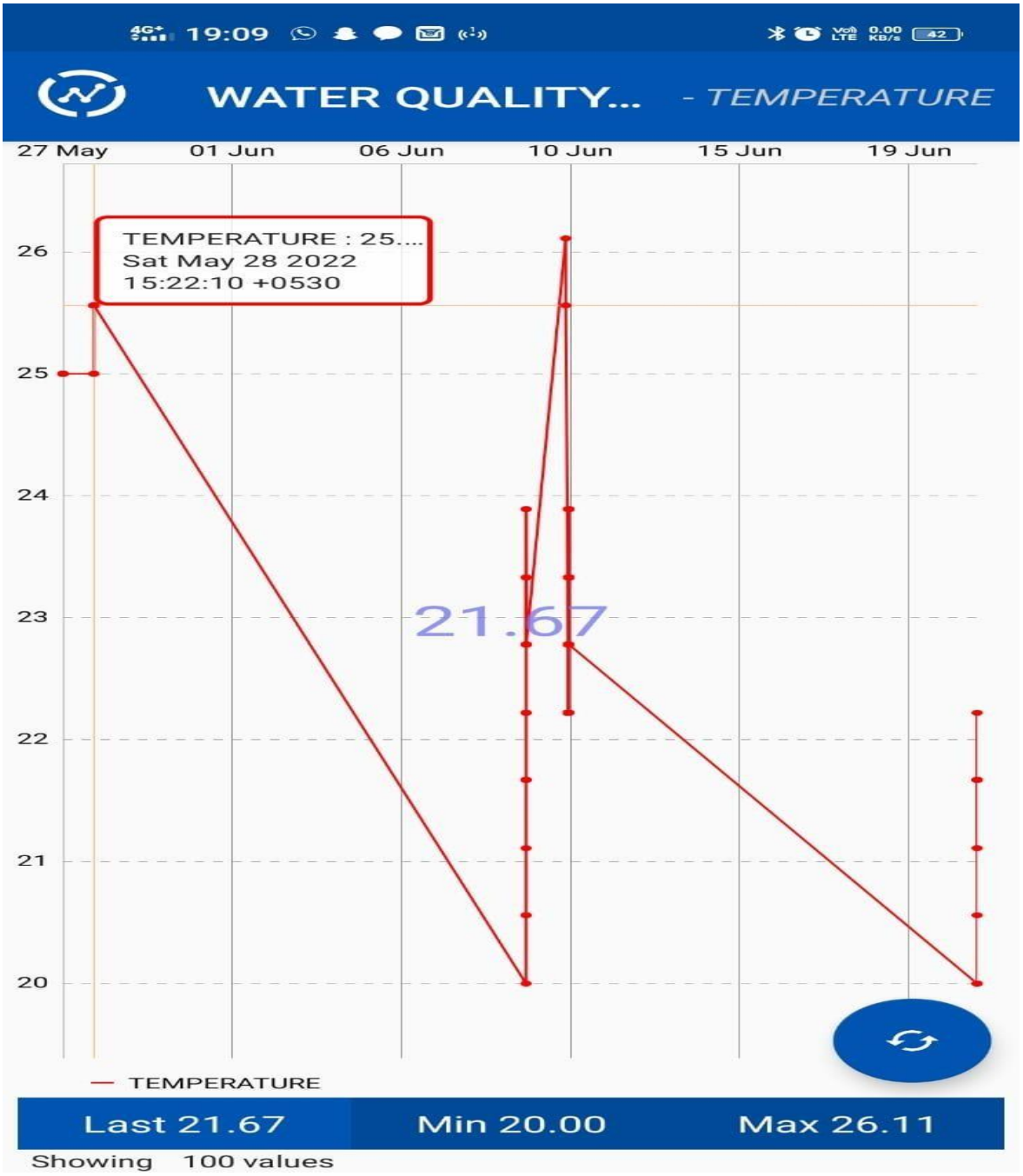


FIGURE Temperature values in cloud storage/ Mobile.

Measuring PH value:

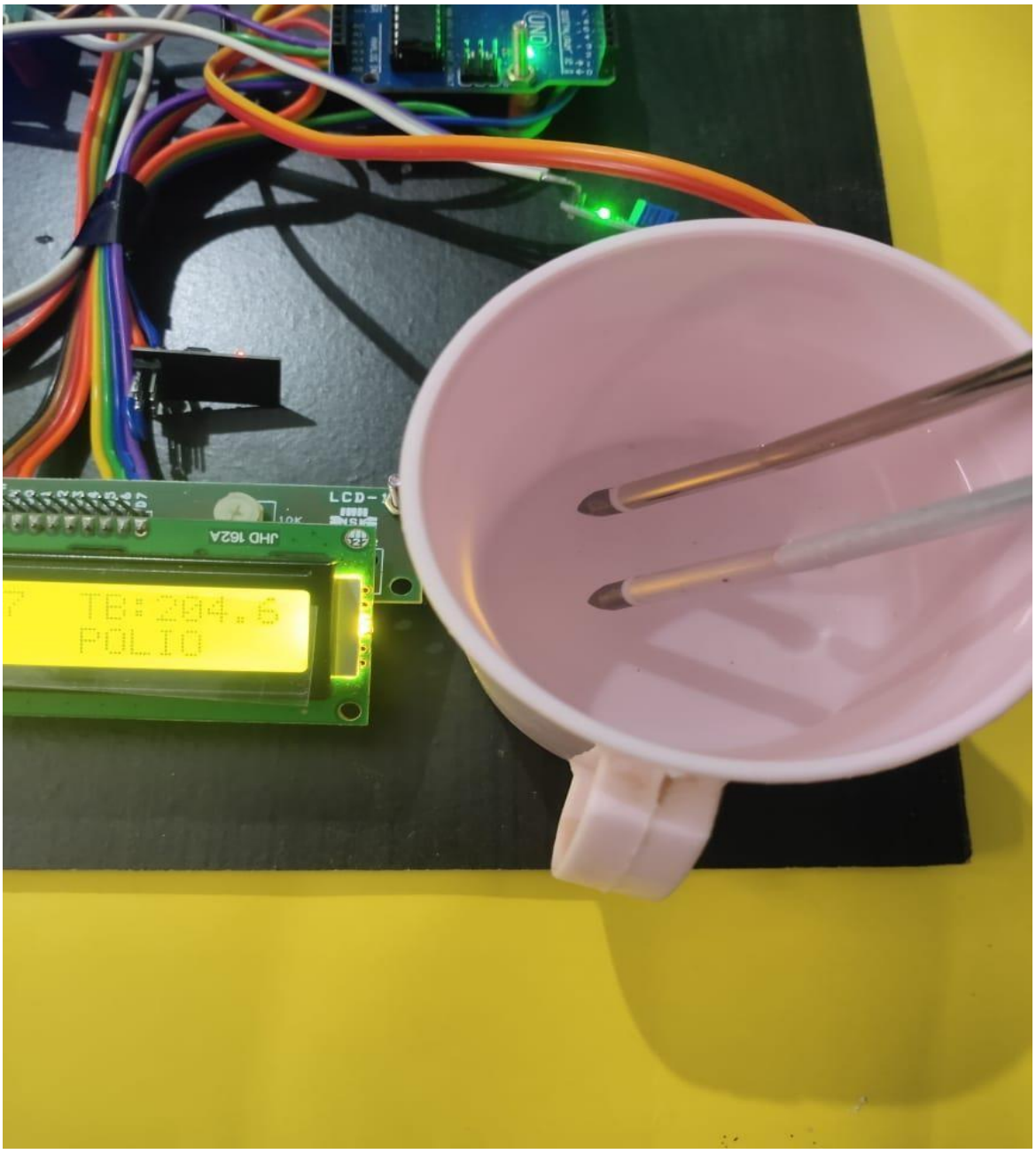


FIGURE Measuring PH value.

Predicting disease and display on LCD display

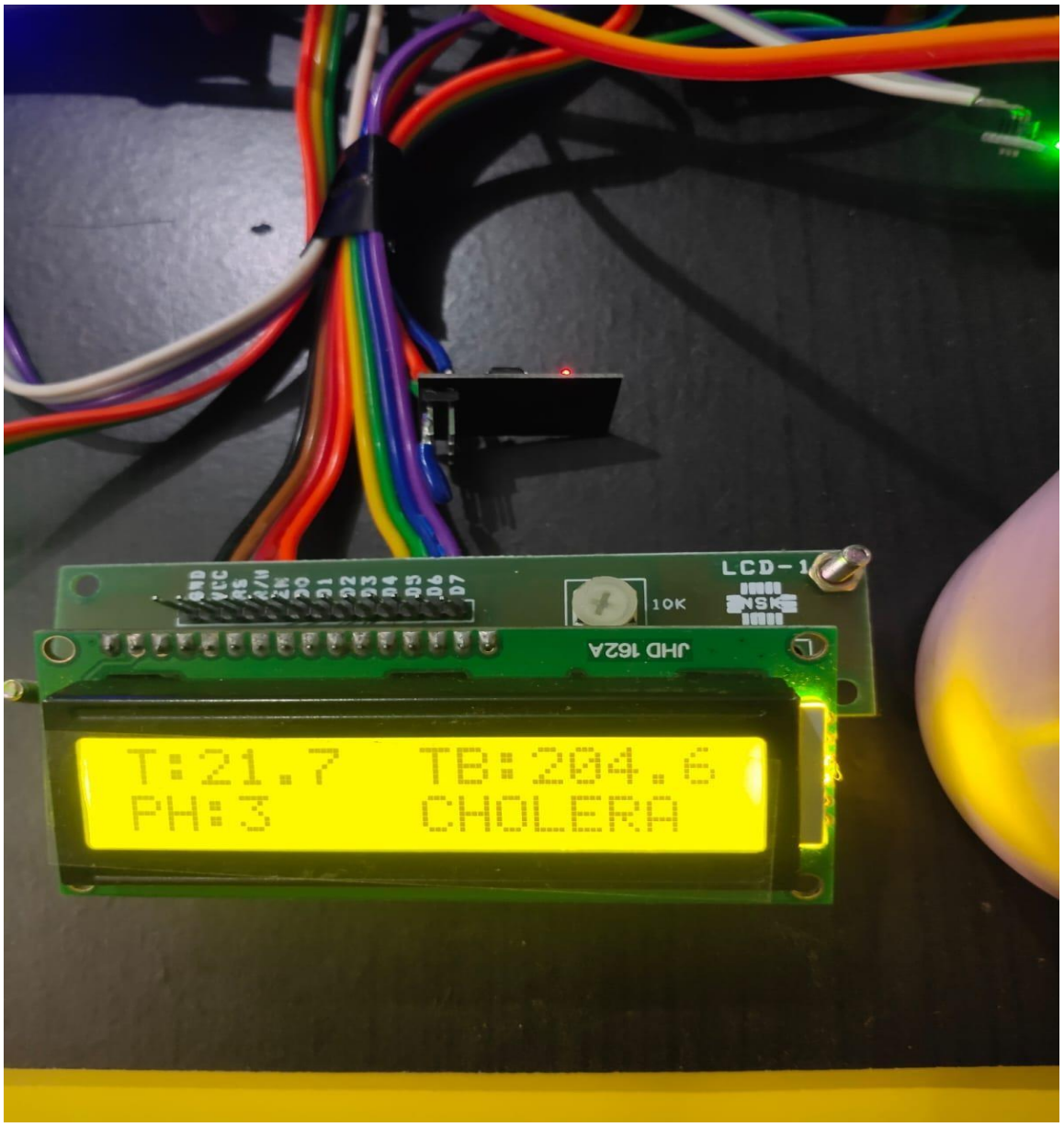


FIGURE Predicting disease and display on LCD display.

Measuring PH value and Prediction disease based on PH value.

FIGURE Measuring PH value and Prediction disease based on PH value.

If water is Safe for Drinking the PH value range from 1 to 2.

FIGURE. If water is Safe for Drinking the PH value range from 1 to 2.

PH value in cloud Storage/ Mobile

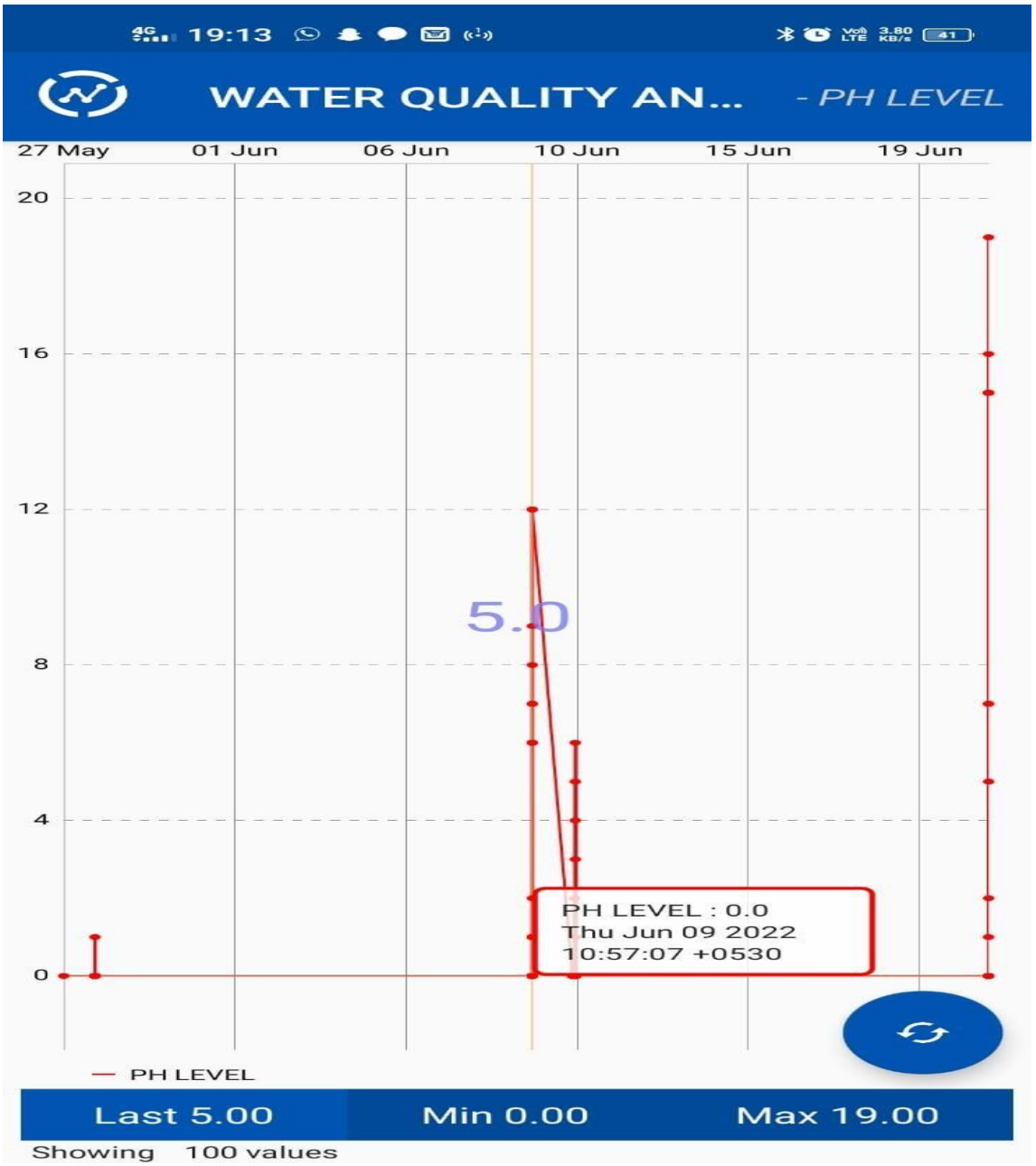


FIGURE PH value in Cloud Storage/Mobile.

CHAPTER

CONCLUSION

When running IoT and ML applications, it is imperative to choose an ML device with a vast library, a fair user interface, and support for regular programming dialects. Therefore, this is a guide to machine learning tools to help you choose the right innovation. Check water turbidity, pH, and temperature using water body sensors with outstanding utilities and existing GSM networks. Thus, the structure can check the water quality, it is the minimum cost and people are not expected to work. Therefore, water quality monitoring will probably be milder, more supportive and more competent. This structure can be used to screen different water quality measurements by replacing virtually identical sensors and adapting critical program modules. This structure can be used to talk about hydrological information verification, pollution, mechanical and agricultural times, and more. We are very grateful for the wide range of uses. In future work, we will apply this pointing to other specific dialects, extending different sensors to extend boundaries and integrating different estimates to create more accurate expected models. This model is used to predict possible water and water-borne diseases. The expected illness is sent to your mobile phone as a pop-up message. Given the accuracy achieved, water-borne infections tend to be shown to be highly predictable given the limits of water quality.

REFERENCES

[1] Monira Mukta, Surajit Das, Samia Islam, Ahmed Wasif Reza (2019), “IOT based Smart Water Quality Monitoring System”, IEEE 4th International Conference on Computer and Communication System.

[2] Durgesh Pant, Ashutosh Bhatt, Muneer Khan,O.P. Nautiyal, Pankaj Adhikari, (2019),"Automated IoT based Smart Water Quality Assessment System" Proceedings of the SMART.

[3] Halima Haque, Kashshaf Labeeb,Rabea Basri Riha , Nasfikur R. Khan,(2021), " IoT Based Water Quality Monitoring System By Using Zigbee Protocol" International Conference on Emerging Smart Computing and Informatics (ESCI).

[4] Prajakta Patil, Sukanya More, Atharv Deshpande, Harshal Todkar, Sanjeev Wagh, (2020), "Water Quality Monitoring for Disease Prediction using Machine Learning" International Journal of Future Generation Communication and Networking Vol. 13, No. 3.

[5] Lakshmi Nandakumar, M Sangeetha, M Annamaria Thomson, Akash Tommy, M P Kiran, P Raji, (2020), "Real Time Water Contamination Monitoring Cloud, IoT and Embedded Platforms", International Conference on Smart Electronics and Communication (ICOSEC), Publication˘2020.

[6] Nageswara Rao Marathi, Mukesh, P. Vidya Sagar "Water Quality Monitoring System Using IOT”, 4th International Conference on Advances in Electrical, Electronics, Information, Communication and Bio-Informatics (AEEICB-18).

[7] Nikhil Kumar Koirala, Dr.Purnendu Shekar Pandey, "Water Quality Monitoring System using IoT and Machine Learning" on 2018 IEEE.

[8] Simitha K M, Subodh Raj M S," IoT and WSN Based Water Quality Monitoring System" Proceedings of the Third International Conference on Electronics Communication and Aerospace Technology [ICECA 2019].

[9] Mannan J M., et.al." Smart scheduling on cloud for IoT-based sprinklerirrigation",2019.

[10] Gopal M.K., Amirthavalli M, applying machine learning techniques to predict the maintainability of open-source software, 2019.

[11] Subhashini, and P. Alli. "Performance Improvisation and Energy Conservation Using DSGC Protocol in Sensor Based Smart Grids." Australian Journal of Basic and Applied Sciences 8(2014): 166-174.

[12] Subhashini, Sottallu Janakiram, and Periya Karappan. "Enabling Resource Awareness in Integrated Sensor Grid Framework Using Cross Layer Scheduling Mechanism." Circuits and Systems 7.10(2016): 3212.

[13] Kumar, Santosh. "HD Video Data Transaction using Bus Mastering Although PCI express." Turkish Journal of Computer and Mathematics Education (TURCOMAT) 12.10 (2021):1970-1973.

[14] Divya, R., and R. Chinnaiyan."Reliability evaluation of wireless sensor networks Reliability Evaluation of wireless sensor network." ICICCS, IEEE,2017.

[15] Godwin, J. Jijin, et al. "IoT Based Intelligent Ambulance Monitoring and Traffic Control System." Further Advances in Internet of Things in Biomedical and Cyber Physical Systems (2021): 269.

[16] Dhivya M, and T. Parameswaran. "Smart scheduling on cloud for IoT-based sprinkler irrigation." International Journal of Pervasive Computing and Communications (2020).

[17] Nirmala A P, Das P K, automatic light control with temperature monitoring and alert mechanism, International Journal of Engineering and AdvancedTechnology,2019.

[18] Karthikayini, T., and N. K. Srinath. “Comparative polarity analysis on Amazon product reviews using existing machine learning algorithms." 2nd International Conference on CSITSS, 2017.

[19] Nithya B and V. Ilango. "Predictive analytics in health care using machine learning tools and techniques. “International Conference on ICICCS,2017.