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IoT Based Water Quality Measurement Device

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ABSTRACT: Water is a limited natural resource that is essential for business, agriculture, and all other life on earth, including humans. Fluctuations in water quality would negatively affect both human and animal health and the ecological balance of species. To avoid harmful consequences for the water quality of lakes, rivers, farms, and other water bodies. Water quality varies by location and environmental factors. This study uses sensors to measure the quality of water, including temperature, pH, flow, and turbidity. The sensors are connected to an ESP8266 NodeMCU microcontroller, and the sensor data is sent to the cloud using ThingSpeak.

KEYWORDS: Microcontroller, Arduino IDE, Sensor, IOT, Thingspeak.

I. INTRODUCTION

In the 21st century, there were lots of inventions, but at the same time were pollutions, global warming and so on are being formed, because of this there is no safe drinking water for the world's pollution. Pollution will degrade the quality and purity of water. Ensuring pure and safer water is really challenging due to undue sources of chemicals and contaminants. Pollution of water can be instigated by numerous ways; one of the main reasons for pollution is industrial waste discharge and city sewage. Secondary sources of pollution are pollutants that enter the water from soils or from atmosphere via rain or from groundwater systems. Usually, soils and groundwater comprises of residues of modern practices in agriculture and also indecorously disposed wastes from industries. The major pollutants of water include viruses, bacteria, fertilizers, parasites, pharmaceutical products, pesticides, nitrates, fecal waste, phosphates radioactive substances and plastics. These materials will not alter the color of the water always, but they might be indiscernible contaminants. Some water quality detection parameters 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 analyzing. This method wastes too much man power and material resource, and has the limitations of the samples collecting, long-time analyzing, the aging of experiment equipment and other issues. Hence there is need of developing better methodologies to monitor the water quality parameters in real time. The water quality parameters pH measures the concentration 1108. It shows the water is acidic or alkaline. Pure water has 7pH value, less than 7pH has acidic, more than 7pH has alkaline. The range of pH is 0-14pH. For drinking purpose it should be 6.5-8.5pH. Turbidity measures the large number of suspended particles in water that is invisible. Higher the turbidity higher the risk of diarrhea, cholera. Lower the turbidity then the water is clean. Temperature sensor measures how the water is, hot or cold. Flow sensor measures the flow of water through flow sensor. The traditional methods of water quality monitor involve the manual collection of water samples from different locations. Therefore, there is a need for continuous monitoring of water quality parameters in real time.

By focusing the above issues, we have to develop and design a low cost water quality monitoring system that can monitor water quality in real time using IOT environment. In our proposed system water quality parameters are measured by the different water quality monitoring sensors such as pH, turbidity, Flow and temperature. These sensor-values are processed by the microcontroller and these processed values are sent to the Thing Speak. In the proposed

system, IOT module is used to access the data from sensor which are connect to controller and sent to cloud. The processed data can be access and monitored from all over the world.

II. RELATED WORK

Many researchers have worked on water quality measurement using the Internet of Things. They have used different sensors to measure various parameters of water quality. Some researchers have used pH sensors, turbidity sensors, temperature sensors, and dissolved oxygen sensors, while others have used conductivity sensors, salinity sensors, and total dissolved solids sensors.

Mukta et al. [1] developed an IoT-based Smart Water Quality Monitoring (SWQM) system that helps in the incessant measurement of the quality of water on the basis of four different parameters of water quality: pH, temperature, turbidity, and electric conductivity. Four different sensors are coupled to the Arduino Uno in order to sense the quality parameters. The data collected from all four sensors is communicated to a desktop application that is developed on the.NET platform, and the extracted data is matched with the standard values. On the basis of the collected data from sensors, the developed SWQM model will efficaciously examine the water quality parameters by employing a fast forest binary classifier for the classification of the sample of water under test as potable or not.

Konde and Deosarkar [2] proposed a method for developing a Smart Water Quality Monitoring (SWQM) system with a reconfigurable sensor interface device in an IoT environment. Sensors, a Field Programmable Gate Array (FPGA) board, and a Zigbee-based wireless communication module were used in the proposed model. Six different water quality parameters, like turbidity, pH, humidity, water level, water temperature, and carbon dioxide (CO₂) on the surface of the water, were considered in real-time. The proposed method will provide assistance in guarding the safe and balanced environment of water bodies. The SWQM system reduces the cost and time associated with determining the quality of water in water resources as part of managing environmental and ecological balance. In the suggested future work, a WSN network will be developed, involving an additional number of nodes to encompass the coverage area.

Nikhil Kedia [3] "Water Quality Monitoring for Rural Areas: A Sensor Cloud-Based Economical Project." Published in the 2015 1st International Conference on Next Generation Computing Technologies (NGCT-2015) in Dehradun, India. This paper highlights the entire water quality monitoring methods, sensors, embedded design, information dissemination procedure, and roles of the government, network operator, and villagers in ensuring proper information dissemination. It also explores the sensor cloud domain. While automatically Although improving the water quality is not feasible at this point, efficient use of technology and economic practises can help improve the quality and raise awareness among people.

Jayti Bhatt, JeneshPatoliya [4] "Real Time Water Quality Monitoring System". This paper describes how to ensure the safe supply of drinking water by monitoring its quality in real time. For that purpose, a new approach based on IOT-based water quality monitoring has been proposed. In this paper, we present the design of an IOT-based water quality monitoring system that monitors the quality of water in real time. This system consists of some sensors that measure the water quality parameters such as pH, turbidity, conductivity, dissolved oxygen, and temperature. The measured values from the sensors are processed by themicrocontroller, and these processed values are transmitted remotely to the core controller, which is the Raspberry Pi, using the Zigbee protocol. Finally, sensor data can be viewed on an internet browser application using cloud computing.

III. METHODOLOGY

The development of a low-cost and effective IOT-based water quality measurement device is the primary focus of this project. The system is built with the help of an microcontroller and various sensors. We have used four different sensors to measure the water quality. The temperature sensor measures the temperature of the water, the pH sensor measures the acidity or alkalinity of the water, the flow sensor measures the flow rate of the water, and the turbidity sensor measures the amount of suspended particles in the water. We have connected these sensors to the NodeMCU ESP8266, which is a Wi-Fi-enabled microcontroller. We have uploaded the sensor data to the cloud using Thing Speak

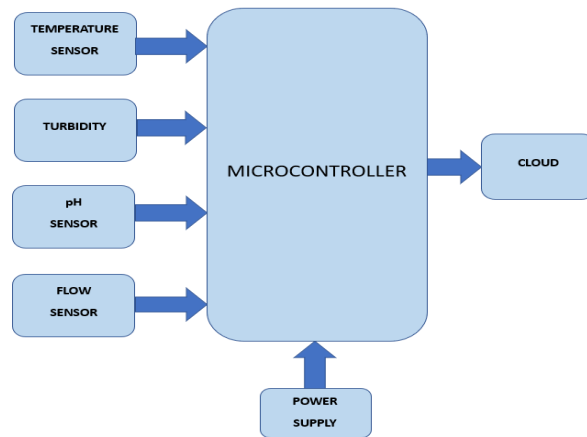


Fig 1.1: Block Diagram of Proposed system

Power- +5V and +9V Supply -->NodeMCU ESP8266 --> Temperature Sensor --> pH Sensor --> Flow Sensor --> Turbidity Sensor -->ThingSpeak Cloud

We have connected the sensors to the NodeMCU ESP8266 as per the circuit diagram. and provide +5V power to the NodeMCU and remaining sensors and providing +9V power to pH sensor. We have programmed the NodeMCU to read the sensor data and upload it to the cloud using ThingSpeak. The processed data can be access and monitored from all over the world. The workings of the project are as follows:

The NodeMCU reads the sensor data.

The NodeMCU connects to the Wi-Fi network.

The NodeMCU uploads the sensor data to the ThingSpeak cloud.

The user can view the sensor data on the ThingSpeak website.

Hardware

a) NodeMCU ESP8266:-



Fig.2.1 NodemcuESP8266

The NodeMCU (*Node MicroController Unit*) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes

pH sensor: 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.



b) pH sensor



Fig. 2.2 pH sensor

C) Turbidity sensor



Fig.2.3 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

D) Temperature sensor



Fig.2.4 Temperature Sensor

Water Temperature indicates how water is hot or cold. The range of DS18B20 temperature sensor is -55 to +125 °C. This temperature sensor is digital type which gives accurate reading.

E)Flow sensor



Fig.2.5 Flow Sensor

Flow sensor is used to measure the flow of water through the flow sensor. This sensor basically consists of a plastic valve body, a rotor and a Hall Effect sensor. The pinwheel rotor rotates when water / liquid flows through the valve and its speed will be directly proportional to the flow rate. The Hall Effect sensor will provide an electrical pulse with every revolution of the pinwheel rotor

IV. EXPERIMENTAL RESULTS

The below figure shows the model that was made to demonstrate and collect data with different inputs and factors like water type, pH of water, temperature of water, turbidity of water, and the flow of water, giving us the necessary data that helps to measure and moderate the quality of water, which later on can be used to predict the quality of water, saving lives and preventing damage to properties with precautionary measures.

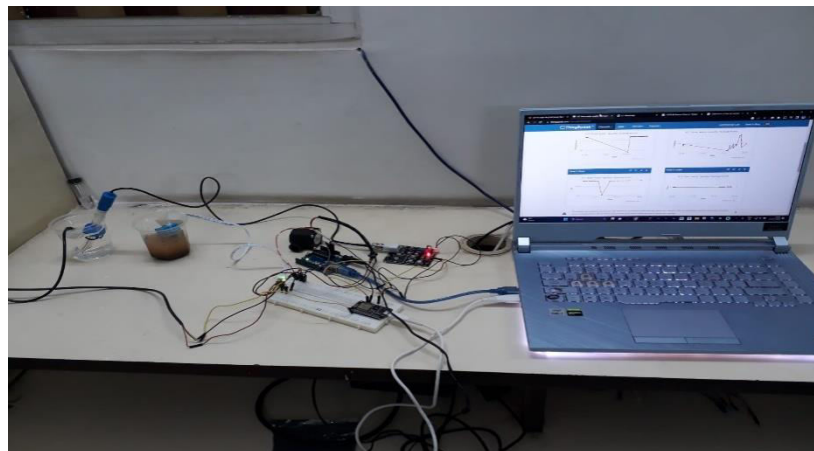


Fig.3. Working model of proposed system.



RESULT:

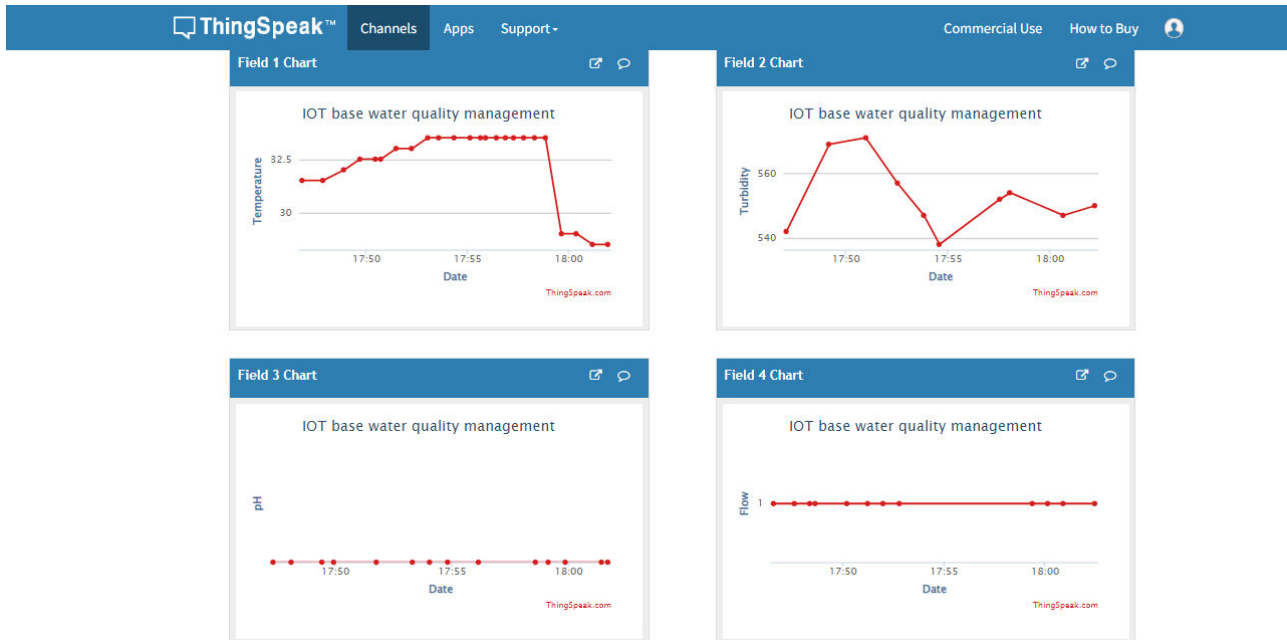


Fig.3.1 Result in graph

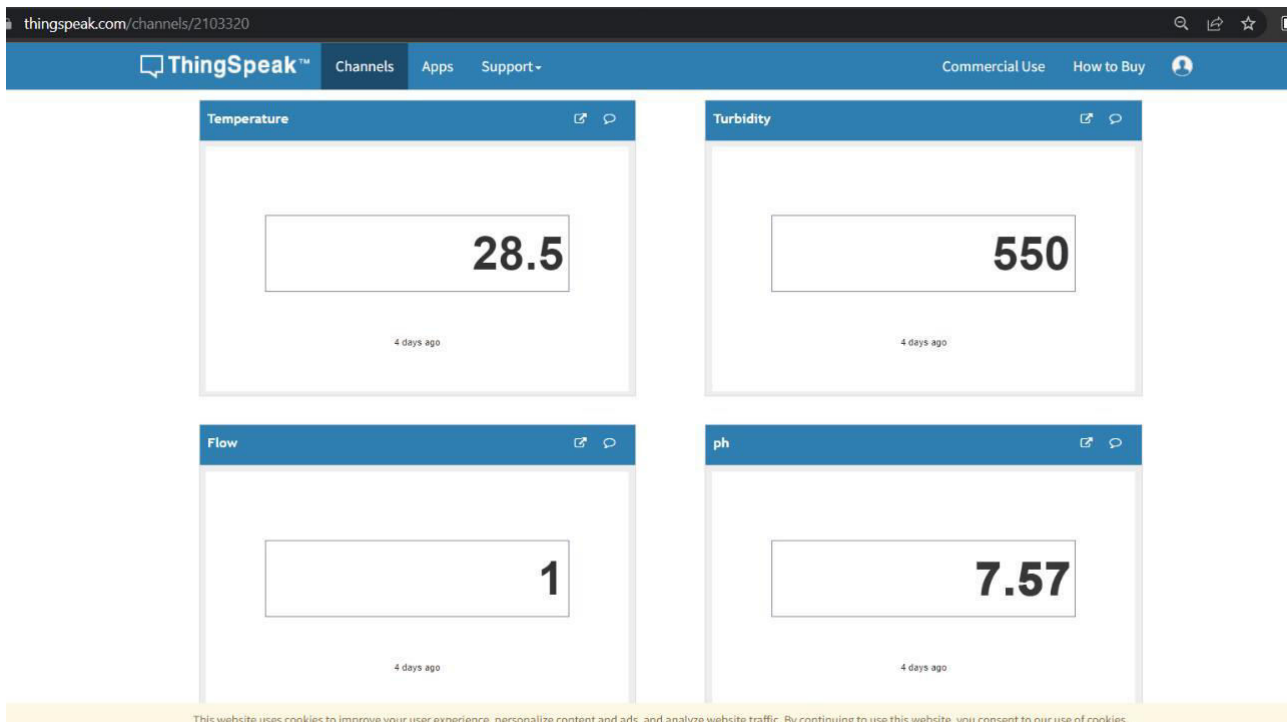


Fig.3.2 Result in Digital



Link for access:-<https://thingspeak.com/channels/2103320>

V. CONCLUSION

Water pollution is a serious threat to all countries because it affects health, the economy, and biodiversity. Based on the existing water quality monitoring systems and scenario studies, it can be said that the proposed system is more suitable for real-time monitoring of water quality parameters. In this system, we control water flow, turbidity, PH, and temperature using water sensors, which have the unique advantage of an IOT environment. The proposed system can automatically monitor water quality, is cheap, and does not require people to work. Just by changing the corresponding sensors and the corresponding software, this system can also be used to monitor other water quality parameters. The operation is simple. The system can be extended to monitor hydrological conditions, air pollution, industrial and agricultural production, etc. It has wide application and extended value.

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