ISSN 2277-2685
IJESR/Apr-Jun. 2024/ Vol-14/Issue-2/1085-1092
Kazi Nikhat Parvin *et. al.*, / International Journal of Engineering & Science Research

IOT-ENABLED SEA WEATHER AND POLLUTION MONITORING STATION

Kazi Nikhat Parvin[1], Marati Vaishnavi[2], Nareddy Srividya[3]
[1]Associate Professor, Department of ECE, Bhoj Reddy Engineering College for Women, Hyderabad, India

[2,3,]UG scholar students Department of ECE, Bhoj Reddy Engineering College for Women, Hyderabad, India

Abstract:
Unlike weather on land, sea weather is highly unpredictable and changes drastically at times. Keeping track of sea weather always is a very tough task. Also, sea pollution is a growing issue of concern and the first step to controlling pollution is measuring it. Another problem is the unavailability of cellular or other data networks in sea or data transmission. It is necessary to always use small sea weather stations with own data transmission capability in the sea to get data about these details. So, we hereby design and develop a small sea weather as well as sea pollution monitoring station that can transmit this data over to the monitoring station on sea shores. The system uses a range of sensors all controlled controlled by an Arduino UNO in order to achieve this task. Along with it we also develop a receiver system to receive and display the data from the transmitter. The transmitter unit is always in the sea and its not possible to constantly charge itself from time to time, so we use a solar panel to allow it to generate its own power and keep working in the sea. The solar panel charges the onboard battery which is used to power the circuitry. The transmitter uses turbidity sensor to check pollution, DHT 11 for Temperature and Humidity levels above the Sea water. Also, the system has an accelerometer sensor to detect sea state, depending on weather the sea is rough or calm, the accelerometer throws values that can be used to check if sea is calm or rough. These values are constantly monitored by the Arduino UNO and transmitted at certain intervals by through a n RF transmitter. The transmitter is fitted with a high gain antenna in order to achieve maximum transmission range. Now the receiver unit is developed using a Node MCU and display in order to receive data transmitted by the transmitter buoy and display it. The receiver unit consists of a n RF receiver with an antenna that is used to receive the data values transmitted by sea unit. This data is now received and processed by the Node MCU. The Node MCU now displays these values on the lcd display. If a value is not normal or beyond set range it also sounds a buzzer alert and displays alert in order to notify station officers to act and warn ships/people in the vicinity.

Introduction

IOT has proven extremely efficient in its ability to churn out piles of data. The Internet of Things, or IoT, has changed the frequency with which we interact with machines. Everyone, from organizations to governments is looking at IoT to streamline processes and improve productivity in newer ways. The utility industry is going through a unique process of innovation and evolution. Renewables, IoT, and Electric Vehicles, among others, are dramatically changing the way wemanage and interact with energy. This revolution comes along with new products and services, competition from outsiders, significantregulatory changes, and a savvier and more demanding consumer. These are challenging the Utilities had never faced in more than a hundred years. Wearable technologies, including smartphones, arecompatible with a plethora of software like heart rate monitors, cameras, and touch/pressure sensors. Many factories and industries are dumping contaminated water, chemicals, and heavy metals into major waterways as a result of direct water pollution. water pollution is the use of modern techniques in farms. Farmers apply nutrients such as phosphorus, nitrogen, and potassium in the form of chemical fertilizers, manure, and sludge. It causes farms to discharge large quantities of agrochemicals, organic matter, and salinedrainage into water bodies. It indirectly affects water pollution. Pollutants can be of various types such as organic, inorganic, radioactive etc. Water pollutants are discharged either from one point from pipes, channels etc. which are called point sources or fromvarious other sources. They can be agricultural areas, industries etc., called dispersed sources. Domestic sewage from homes contains various forms of pathogens that threaten the human body. Sewage treatment reduces the risk of pathogens, but this risk is not eliminated. Water bodies get polluted because of heat, and excessheat reduces the oxygen level of the water bodies. The disposal of coldwaters from the power plants leads to increased thermal pollution in the water bodies. Our oceans are the largest carbon sink on the planet. It is necessary to always use small sea weather stations with own data transmission capability in the sea to get data about these details. So, we hereby design and develop a small sea weather as well as sea pollution monitoring station that can transmit this data over to the monitoring station on sea shores. Recently, the World Meteorological Organization called for a 'drastic change of course', following a report highlighting the impacts of climate change, associated sea level rise extreme weather and record greenhouse gas levels. The ocean

is where most of our environmental pollution ends up contaminated by industries from agriculture to tourism. There is a proverb that anyone with a passion for the environment should be familiar with: "Dilution is the solution to pollution." The ocean cannot and should not be the destination for all our waste. After all, the future of mankind depends on this vast body of water and all the lives inside it.

Block Diagram

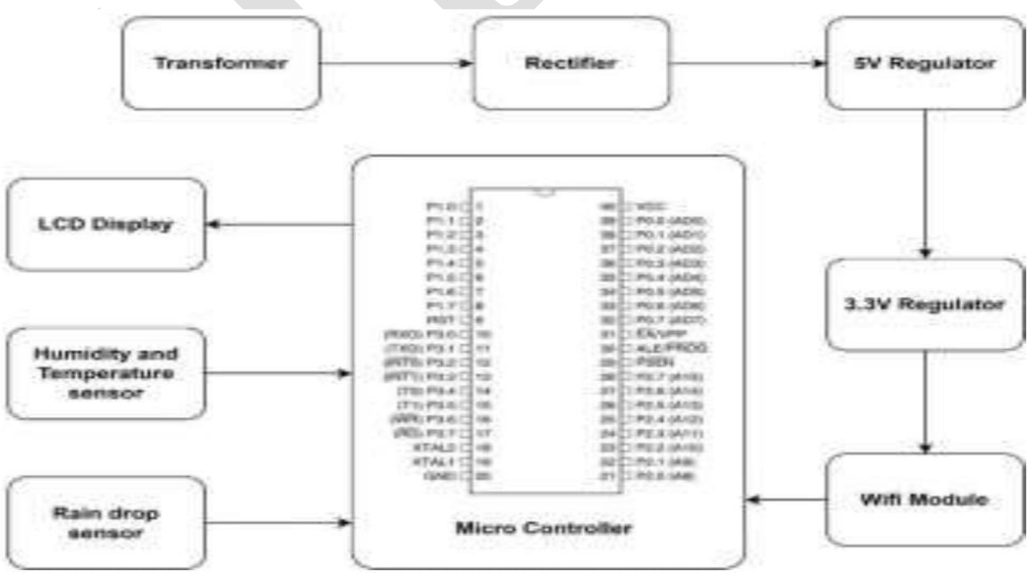


Fig 2.1 Block diagram of Sea weather and Pollution Monitoring Station

Micro Controller Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a micro controller) and a piece of software or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

Temperature and Humidity sensor (DHT11): It is used for sensing temperature and humidity. It gives an analog voltage output that can be processed further using a microcontroller.

Accelerometer Sensor: An accelerometer sensor is a tool that measures the acceleration of any body or object in its instantaneous rest frame.

Turbidity Sensor: Turbidity sensors are used to measure the cloudiness or haziness (turbidity) of a liquid, usually to determine water quality.

MQ-3 Sensor: Gas Sensor (MQ3) module is useful for gas leakage detection (in home and industry). It is suitable for detecting Alcohol, Benzine, CH4, Hexane, LPG, CO. Due to its high sensitivity.

Node MCU: The Node MCU (Node Microcontroller Unit) is an opensource software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266.

WiFi Module: Wi-Fi module or other wireless communication module. Integrating a Wi-Fi module into a Sea Weather and Pollution monitoring Station can enhance communication capabilities, allowing for real-time data transmission and remote monitoring.

Power Supply: For the embedded board and sensors.

Transformer: Transformers, which are a type of deep learning model, have found applications in various domains, including environmental monitoring. Using a transformer-based model in a Sea Weather and Pollution Monitoring Station can enhance the station's ability to analyze and predict environmental conditions.

Rectifier: A rectifier is used to convert alternating current (AC) into direct current (DC). This is important because many electronic components and sensors operate on DC power.

5V Regulator: A voltage regulator is used to maintain a stable output voltage regardless of variations in the input voltage or load conditions. In this case, a 5V regulator ensures that the voltage supplied to sensitive electronic components remains at a constant 5 volts.

3.3V Regulator: In a sea weather and pollution monitoring station, a 3.3V regulator plays a crucial role in providing a stable and regulated power supply to components that operate at 3.3 volts.

LCD Display: LCD displays everywhere around us Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time. An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

Results

Thing Speak is an open-source Internet of Things (IoT) platform that provides a based service for collecting, storing, analyzing, and visualizing data from connected devices. It offers a simple and easy-to-use interface for IoT developers and enthusiasts to create IoT applications and projects without the need for complex coding or infrastructure setup. Thing Speak is hosted in the cloud, which means that the data collected from connected devices is stored and processed on remote servers, allowing for scalability, accessibility, and ease of use. Some key features of Thing Speak's cloud-based platform include: Data

Collection: Thing Speak allows users to send data from connected devices using HTTP, MQTT, or other protocols. Data can be sent in real- time or in batch mode, and users can define custom fields to store different types of data. Data Storage: Thing Speak provides cloud-based storage for the collected data, allowing users to store and manage large amounts of data without worrying about local storage limitations. Data can be stored in channels, which are virtual containers for data streams, and users can configure data retention policies. Data Analysis: Thing Speak offers built-in data analysis capabilities, including MATLAB analytics, which allows users to perform mathematical computations, data filtering, and data visualization. Users can also write custom analysis scripts using MATLAB or other programming languages. Data Visualization: Thing Speak provides tools for visualizing data in the form of charts, gauges, maps, and more. Users can create customizable dashboards to display data in a visually appealing and meaningful way. IoT Integrations: Thing Speak can be integrated with various IoT devices, platforms, and services, making it easy to connect and collect data from a wide range of IoT devices, sensors, and applications. Real-time outputs can be visualized in various formats such as dashboards, graphs, charts, or alerts, making it easy for project teams to interpret and understand the data quickly. Visualizing real-time outputs can enhance communication, collaboration, and decisionmaking among project stakeholders.

Integration: Real-time outputs can be integrated with other project management tools or systems to enable seamless data flow and facilitate decisionmaking. For example, real-time data from a project management software can be integrated with a project scheduling tool to automatically update project timelines based on real-time progress data. Hear we can upload up to 8 Fields for 8 different sensor values if we need more fields for more sensors, we can go through the premium policy of the things peek to display the values and, we are having different widgets for displaying those values like (graphs, pie charts, bar graph, speedometer etc.,)

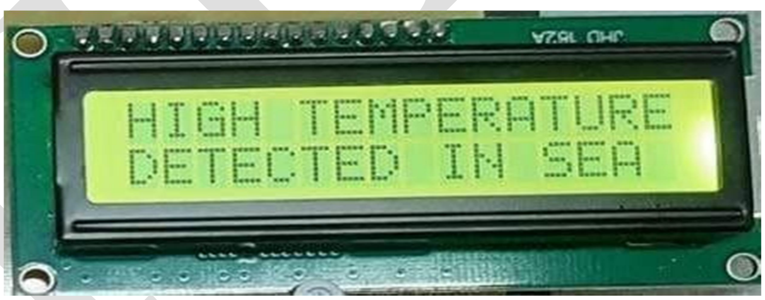


Fig 4.1 High Temperature display on LCD

For every 30 seconds passes the information through wifi module and updates the particular values to cloud again after updating it slowly comes to the constant value . Led updates to thingspeak for every 30 seconds.

Fig 4.2 Humidity values from Cloud

The above image talks about the Field 2 chart for the Humidity the above readings are Uploaded from the Receiver station (NodeMCU) humidity values to the cloud. If the humidity is above 70 its gives buzzer sound and displays high humidity is detected near the sea .

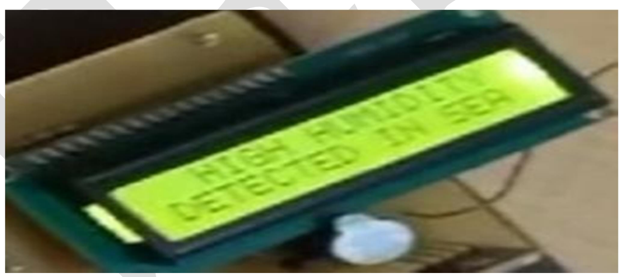
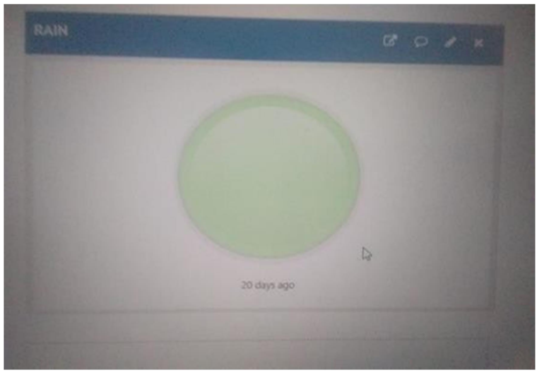


Fig 4.3 High humidity display on LCD

Before updating the information in the cloud it will be in the range 56. For every 30 seconds passes the information through wifi module and updates the particular values to cloud again after updating it slowly comes to the constant value .Led updates to thingspeak for 30 seconds time.

Fig 4.4 Rain detected displayed on LCD



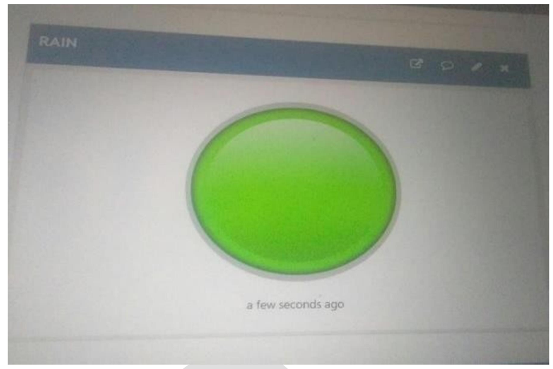


Fig 4.5 No Rain indication in sea

Fig 4.6 Rain indication in sea

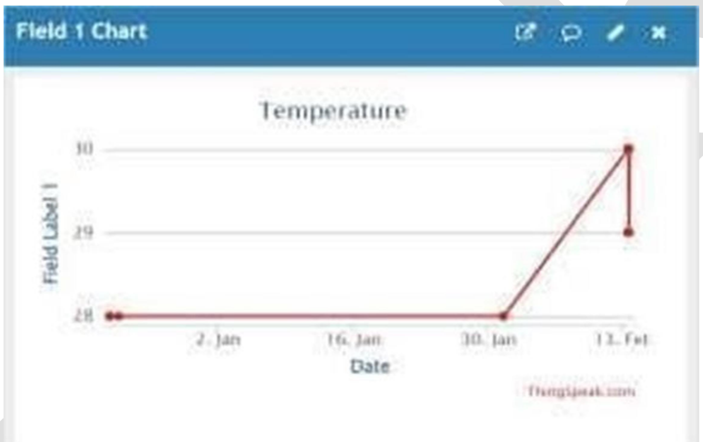


Fig 4.7 Temperature Values form Cloud

The above image talks about the Field 1 chart for the Temperature the above readings are Uploaded from the Receiver station (NodeMCU) Temperature values to the cloud.If the temperature is above 37 its gives buzzer sound and displays high temperature is detected near the sea.Before updating the information in the cloud it will be in the range 30 centigrade

Conclusion

In this chapter, we understood the advantages, disadvantages, applications, future scope and conclusion. The solar sea weather and monitoring station project is a sustainable and innovative solution for continuous monitoring of weather conditions and sea levels in coastal areas. It operates autonomously using solar energy, is equipped with various sensors, and provides realtime data transmission for accurate weather forecasts and early warning systems. The project is scalable, customizable, and has the potential to significantly improve our understanding of the impacts of climate change on coastal environments. Overall, it represents a significant step forward in the development of sustainable, data-driven solutions for coastal monitoring and management. The future scope of solar sea weather monitoring stations is vast, as technology continues to advance and the need for accurate environmental data grows.

Future Scope

The future scope of a project focused on advanced sensor technology: As sensor technology advances, solar sea weather monitoring stations may be equipped with even more precise and sensitive sensors, allowing for more detailed and accurate data collection.

Artificial intelligence and machine learning: With the growing amount of data being collected, the use of artificial intelligence and machine learning algorithms may become increasingly important in analyzing and interpreting the data. Expansion of the Internet of Things (IoT) infrastructure to enable seamless connectivity between monitoring stations, allowing for realtime data sharing and collaborative monitoring efforts across different regions.

References

[1] J. Shivang, S. S. Sridhar, "Weather prediction for Indian location using Machine learning," International Journal of Pure and Applied Mathematics, vol. 118, no. 22 pp. 1945-1949, 2018.

[2] Z. U. Khan and M. Hayat, "Hourly based climate prediction using data mining techniques by comprising entity demean algorithm" Middle-East Journal of Scientific Research 21, vol. 8, pp. 12951300, 2014.

[3] S. S. Bhatkande1, R. G. Hubballi2, "Weather Prediction Based on Decision Tree Algorithm Using Data Mining Techniques." Belgaum India: International Journal of Advanced Research in Computer and Communication Engineering, vol. 5, no.5, pp. 483- 48, 2016.

[4] Y. Radhika, and M. Shashi, "Atmospheric temperature prediction using support vector machines." International Journal of Computer Theory and Engineering 1.1, vol. 1, no. 1, pp.1793-8201, 2009.

[5] S.S. Badhiye, B. V. Wakode, P. N. Chatur, "Analysis of Temperature and Humidity Data for Future Value Prediction" International Journal of Computer Science and Information Technologies, vol. 3, no.1 pp.3012- 3014, 2012.

[6] F. Olaiya, Adesesan Barnabas Adeyemo, "Application of Data Mining Techniques in Weather Prediction and Climate Change Studies," IJCSNS International Journal of Computer Science and Network Security, vol.17, no.6, pp 22-25, 2017.

[7] S. Ochoa-Rodriguez, L. P. Wang, P.Willems, and C. On of, "A review of radarrain gauge data merging methods and their potential for urban hydrological applications," Water Resource. Res., vol. 5, no. 8, pp. 6356–6391, Aug. 2019.

[8] PiyushKapoor and Sarabjeet Singh Bedi " Weather Forecasting Using Sliding Window Algorithm", Kvantum Inc., Gurgaon 122001, India MJP Rohilkhand University, Bareilly 243006, India, 2013 [9] Huang, C., Yang, Y., & Li, S. (2017). Design of sea water monitoring system based on Internet of Things. Journal of Physics: Conference Series, 869(1), 012039.

[9] Liu, Y., Zhang, B., & Gao, X. (2017). A sea water pollution monitoring system based on Internet of Things. International Journal of u- and e- Service, Science and Technology, 10(1), 43-52.

[10] Aman, S., Abdullah, M. F., Ahmed, I., Imran, M. A., & Abbasi, A. (2017). Internet of Things (IoT) based system for real-time water quality monitoring in Aquaculture. Computers, Materials & Continua, 53(1), 61-77.

[11] Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2018). Internet of Things (IoT): A vision,

architectural elements, and future directions.

[12] Masot, R. M., González-Partida, J. T., Jiménez-Moreno, G., & Baca, G. (2020). Sea water quality monitoring system based on Internet of Things for the Gulf of Mexico. Ocean Engineering, 201, 107006.