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ENVIRONMENT MONITORING SYSTEM USING WIRELESS SENSOR NETWORK

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ABSTRACT

Climate change is occurring and becoming more intense over the past years where it affects our now entire globe. The climatic change involves heat waves, heavy downpours, sea-level rise, ocean acidity, flooding, and drought. To minimize these effects, prevention must be taken and one of the precaution steps is to sense and monitor the environmental parameters such as temperature and relative humidity in the remote area, Air quality sensor, Rain sensor. In this report we describe the implementation of the wireless network known as Low Power Wide Area Network (LPWAN) and explore the performances of the Lora Technologies n the development of the monitoring system. In the project, the Arduino connected with Lora via Google cloud and in conjunction with a few sensors that work as sensor nodes and send the valuable data to the gateway over the long range at a very low-data-rate with low power consumption. Finally, the proposed system shows 98% of Packet Reception Ratio (PRR) was successfully received which is proficient enough to monitor the condition of the environment. This Lora module is applicable for real-time monitoring purposes that require continuous data analysis.

I. INTRODUCTION

Wireless communication has come a long way, moving from tangled wired networks to the seamless convenience of wireless systems. Among the many innovations in this field, Low Power Wide Area Networks (LPWANs) stand out for their ability to connect devices over long distances while using minimal power. This makes them ideal for applications in remote areas where constant monitoring is needed, but high data speeds aren't a priority.One of the leading LPWAN technologies is LoRa (Long Range), developed by Semtech. LoRa operates in the unlicensed ISM (Industrial, Scientific, and Medical) band, using a special modulation technique called Chirp Spread Spectrum (CSS). This allows it to transmit data over vast distances while resisting interference, making it perfect for applications like environmental monitoring, smart farming, industrial automation, and remote healthcare.

In this report, we explore LoRa's physical layer, its key parameters, and how it performs in real-world scenarios. To put it to the test, we developed a prototype environmental monitoring system using LoRa technology and analyzed its performance based on factors like signal strength, data reliability, and communication range. The findings highlight how LoRa's low power consumption, long-range capability, and robustness make it a strong choice for real-time monitoring in remote locations.

II. LITERATURE SURVEY

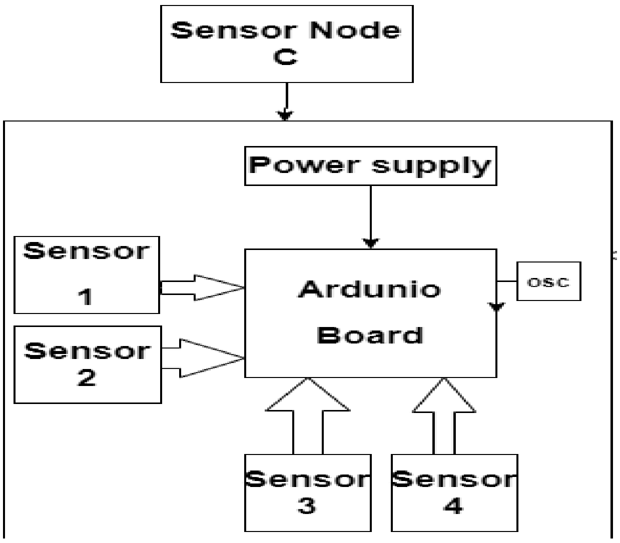
Sr. No	Author	Paper Title	Publication	Date
1	Shimona Prabhu M,Dr Annapurna D, Shamshirun Ibrahim.	"Remote weather assistant using LoRa network, an enhancement of IoT design"	High Security Registration Plate (HBRP) Publication	1 sep 2019
2	Jiaheng Wang, Chenxu Fu, Zhenbang Liu.	"Design of a smart sensor network system for real-time air quality	Hindawi journal of sensors	2 Aug 2018

		monitoring in green roof"		
3	B.Bathiya, S.Srivastava and B.Mishra	Air pollution monitoring using wireless sensor network	IEEE international WIE conference	2016
4	P.Agnihotri,S.Tiwari and D,Mohan	"Design of air pollution monitoring system using wireless sensor network"	International conference on electrical and electronics engineering(ICE 3)	2020

III. METHODOLOGY

The main aim of this project is to successfully implement the following design stages

1. Interfacing the ardunio
2. Setting up the communication lie between transmitter and receiver.
3. Creating a software program for microcontroller to receive data.
4. Processing the data by displaying the value on the servers



IV. SYSTEM SPECIFICATIONS

The wireless weather monitoring system uses IOT technology to make farming smarter and more Efficient by automating and monitoring surrounding environment. the system relies on the sensor That monitor the air moisture, smoke, temperature, rain to collect real time data. This data is processed by ESP-32 the collected data is transferred to a website which provide graph of data

Overall, the system brings benefits like information efficiency, cost saving by using less water and temperature this will give the satisfaction to user by the data which he has before reaching the field

Component Required

1. Arduino Uno
2. Gas sensor MQ135
3. Rain sensor
4. Temperature sensor LM35
5. Humidity sensor SY-H5220
6. Power supply(5V)
7. 16*2 LCD

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V. TECHNICAL SPECIFICATIONS

1. Microcontroller

Arduino (ESP-32) :

Dual-core Tensilica LX6 processor

Wi-Fi and Bluetooth connectivity

Low power consumption, ideal for IoT applications

2. Sensors

Air Quality Sensor (MQ-135) :

Detects gases like ammonia, nitrogen oxides, CO2, benzene, alcohol

Analog output based on gas concentration (10 ppm to 1000 ppm)

Requires 5V power supply

Rain Sensor :

Detects presence and intensity of rain

Works based on changes in conductivity or resistance

Requires 5V power supply

Temperature & Humidity Sensor (DHT11) :

Temperature range: 0°C to 50°C

Humidity range: 20% to 90% relative humidity

Requires 5V power supply

Temperature Sensor (LM35) :

Linear temperature output

Operating range: -55°C to 150°C

Accuracy: ±0.5°C

3. Communication Module

LoRa Module (Embedded with ESP-32) :

Long-range wireless communication (1-2 km)

Low power consumption

Connects sensor nodes to the central node and uploads data to the cloud

4. Display

LCD 16x2

Displays real-time data from sensors

Used for local monitoring

5. **Power Supply**

DC-DC Down Converter :

Converts high DC voltage to required lower voltage for components

6. **Software & Programming :**

Programming Language: C++ (Embedded C)

Development Tools: Arduino IDE

Algorithm

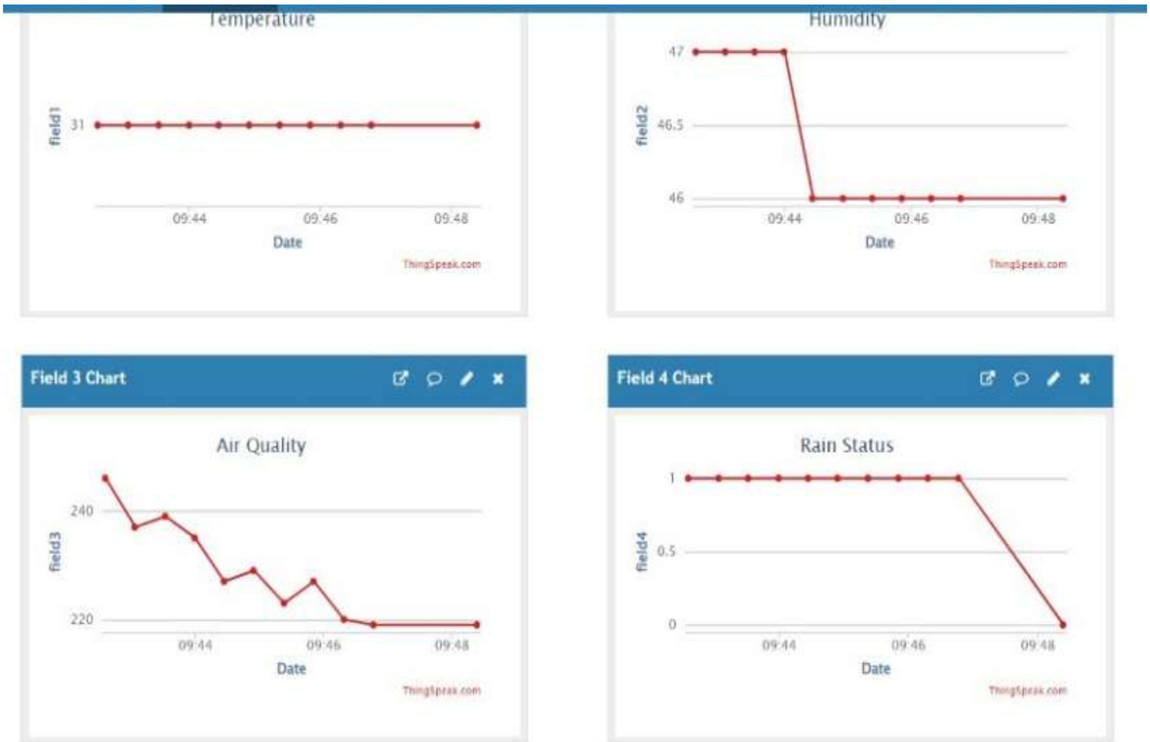
7. **System Architecture :**

Master Node: Collects sensor data and uploads it to the cloud

Sensor Node: Collects environmental data and sends it via LoRa

IoT Cloud: Stores and visualizes environmental data

VI. RESULTS AND GRAPHS



VII. CONCLUSION

This paper provides preliminary works and results for environmental monitoring system using the LoRa communication network from sensor nodes to a LoRa gateway that located 10km far. The sensor node consists of an environmental sensor has been presented and can be used remotely to collect real-time environmental information. The results for RSSI and SNR indicate the signal quality and its performances to transmit the data from the sensor node to the gateway. To accomplish the research work, the cloud for IoT system needs to be applied using Thing Speak or any other open clouds platform for online processing data storage and analytics system. In the future, further research was planned to add more end –node to analyze the concurrent transmission using different SF while monitoring and collecting environmental data from different locations with more variety of sensor.

VIII. REFERENCE

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