International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 2170-2174 www.ijaem.net ISSN: 2395-5252

Lora Based wireless weather station with web-server

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Submitted: 15-06-2022 Revised: 25-06-2022 Accepted: 27-06-2022

ABSTRACT: This study develops a prototype of a weather station with LoRa wireless infrastructure . LoRa is a wireless connectivity technology supporting the internet of things (IoT) system. This technology is an alternative to other wireless connectivity modules that have already been popular such as GSM modules, Wifi Modules and Bluetooth (BLE). The use of the LoRa network serves to increase the range of wireless cells that can reach distances of up to 5 kilometers while still having low power consumption. Weather parameters measured include temperature, humidity, air pressure, rain detection and soil moisture.The prototype consists of Arduino nano &ESP32 Wifi module. We use the sensors like BME280 Barometric pressure BH1750 light sensor,Rainsensor,Soil moisture sensor with motor pump.By using the LoRa Module SX1278/RFM95 can monitor the data from a few kilometer distance.The gateway placed indoors ,insidethe house or can be placed at a certain height to achieve a long distance.The gateway is made using LoRa SX1278/RFM95 and ESP32 wifimodule.The receiver collects the data from the sensor or sensor Node and uploads it to the server.

KEYWORDS:ARDUINO NANO,LoRa Module SX1278/RFM95,ESP32 wifi module.

I. INTRODUCTION

Weather is related to the conditions of temperature, humidity and wind in a place for a certain period. The weather is generally always changing. Sometimes there is a dry season, rain, until snowfalls. The weather is generally influenced by three elements namely the sun, water, and wind. Sunlight produces energy that can control the water cycle. The wind carries clouds that contain water vapor moving towards places with lower air pressure. The air and clouds shrink to become heavier and fall to the ground so that it rains. Weather conditions are very influential in human activity so it is very necessary to measure weather conditions in real-time. The weather data will be used for weather prediction and agricultural planning, health, tourism, and so on. In the process of weather observation, a set of instruments is needed to be placed in a certain location to represent the environmental conditions of the surrounding area. A weather station is a set of tools used to observe conditions or changes in weather, climate, and atmosphere in an area and record it in the form of data. After being recorded, the data is stored in a data logger and subsequently to be studied by users or researchers. An automatic weather station is an instrument that measures and records meteorological parameters using sensors. This sensor serves as a measuring tool to measure any changes in the weather. After the measurement data from the weather station is collected, the process can be carried out locally at the location of the weather station or the data can also be collected at the acquisition data center unit, which later the data collected is automatically forwarded to the data processing center and then processed as needed.

II.WORKING PRINCIPLE:

Weather Monitoring Systems are used to monitor the continuously changing climatic conditions. The data gathered by such devices is used to forecast weather as well as keep a log of the environmental changes at a place. Such data is extremely useful in the study of earth and analyzing the changing climatic and environmental conditions at a place. Further, the data and analytics so collected can be utilized in a variety of applications like agriculture, geology, mining and weather forecast. In this project, a simple weather

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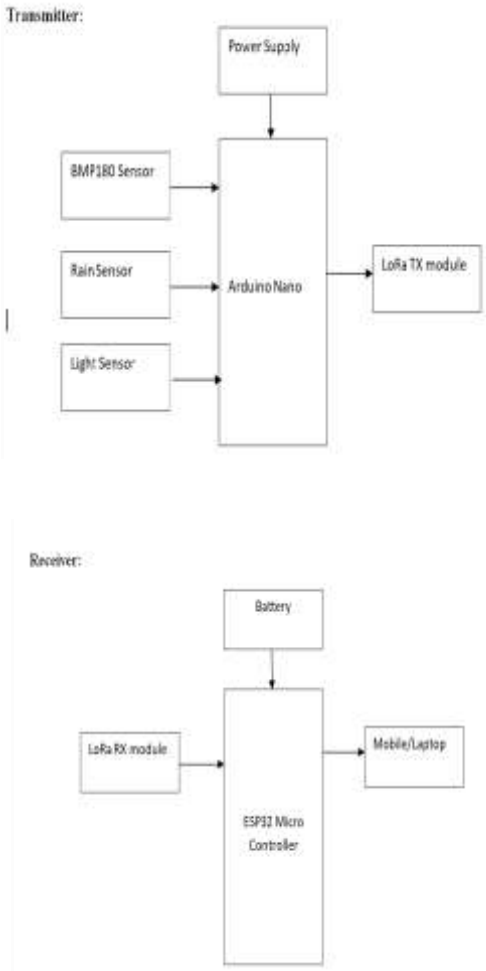
monitoring system is designed which can monitor the temperature and humidity of a place.
The weather monitoring system designed in this project is an IOT device built on Arduino IDE. Arduino IDE is a development environment software where the code is return and it is the software that we can use to dump our written code into the ESP32 andarduino Nano.

The Sensors are connected to the arduino nano and These Sensors namely BMP180, light sensor and Raindrop sensor module sense the data from the environment and gives the collected information to the arduino nano. The arduino nano has Lora module connected to it and a inbuilt Wi-Fi module for ESP32.After all the connections are made the arduino nano is connected to the computer by which we dump the program written in to the arduino nano. The arduino nano is programmed in such a way that it transmits the information collected to the web server where the data is monitored. In the web server we can monitor the pressure,altitude, Temperature, Light intensity and rainfall. Whenever there is a rainfall the LED placed on the board will glow indicating rainfall.

The hardware that is used in this project might not be a huge but it is certainly one of the highlights of this project. ESP32 andarduino Nano is an eLua based firmware for the ESP32 Wi-Fi SOC from Espressif. The firmware is based on the Expressif NON-OS SDK and uses a file system based on spiffs. The code repository consists of 98.1% C-code that glues the thin Lua veneer to the SDK. The ESP32 andarduino Nano **firmware** is a companion project to the popular NodeMCU dev kits, ready-made open source development boards with ESP8266-12E chips. Sensors used are light,BMP180,, rain module. Each sensor has its own prominent role.

III.BLOCK DIAGRAM:



IV.HARDWARE DESCRIPTION

ARDUINO NANO

Arduino Nano is a small, compatible open-source electronic development boardbased on an 8-bit AVR microcontroller. Two versions of this board are available, one is based on ATmega328p, and the other on Atmega168. Like other Arduino boards, the operating voltage of this device is 5V, while input voltage ranges between 6V to 20V while the recommended input voltage ranges from 7V to 12V. The clock frequency of this unit is 16MHz which is used to generate a clock of a certain frequency using constant voltage. The board supports a USB interface and it uses a mini USB port, unlike most Arduino boards that use the standard USB port. The flash memory is used to store the program and the flash memory of Atmega168 is 16KB (of which 2KB is used for the Boot loader) and the flash memory of Atmega328 is 32Kb.

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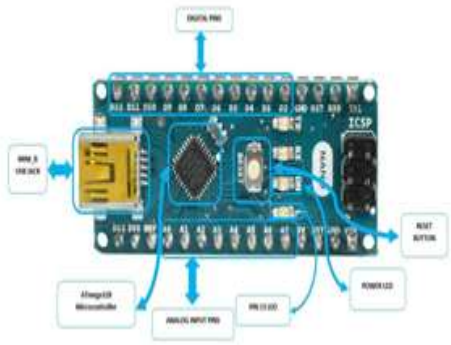


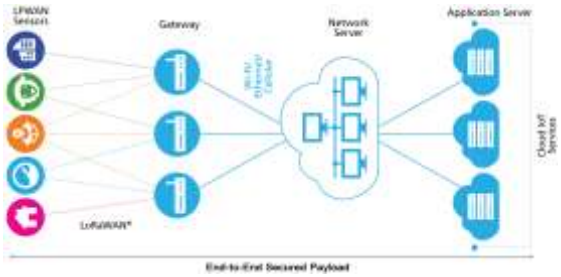
ESP32 Micro controller

Few years back, ESP8266 took the embedded IoT world by storm. For less than $3, you could get a programmable, WiFi-enabled microcontroller being able to monitor and control things from anywhere in the world. Now Espressif (The semiconductor company behind the ESP8266) has released a perfect super-charged upgrade: the ESP32. Being successor to ESP8266; not only does it have a WiFi support, but it also features Bluetooth 4.0 (BLE/Bluetooth Smart) – perfect for just about any IoT project.

ESP-WROOM-32 Module

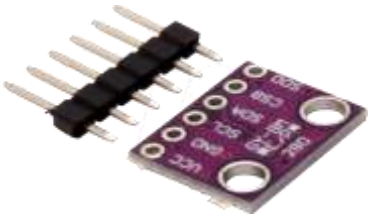
LORA MODULE:

In the last couple of years, there is a number of communication technologies available for interaction between **IoT devices**. The most popular ones are the **Wi-Fi** Technology and **Bluetooth** Module. But they have few limitations like **limited range and access points**. The **power consumption** of Wi-Fi and Bluetooth technology is high which drains the battery quickly if you go for battery-powered mobile device.The IoT devices need to transmit information to a long distance without using much power. So there was a revolution in the IoT field when the LoRa technology was introduced. LoRa Technology can perform very-long range transmission with lowpowerconsumption. The term **LoRa** stands for **Long Range**. It is **a long-range, low power** wireless platform that has become the de-facto technology for **Internet of Things (IoT)** networks worldwide. LoRa is a spread spectrum modulation technique derived from **chirp spread spectrum (CSS) technology**.LoRa modules do come in different frequency ranges, the most common being the **433MHz, 915MHz and 868MHz.** This LoRa technology can be used to transmit bi-directional information to long-distance **(15-20km)** without consuming much power. The technology can be utilized by public, private or hybrid networks and provides greater range than Cellular networks



BMP180/280 SENSOR

The BMP180 is the following-generation of sensors from Bosch, and replaces the BMP085. the coolest information is that it is completely same to the BMP085 in phrases of firmware/software program - you could useourBMP085 tutorial and any example code/libraries as a drop-in alternative. The XCLR pin isn't physically present on the BMP180 so if you need to recognize that statistics is ready you may need to query I2C bus.



This board is 5V compliant - a three.3V regulator and a i2c level shifter circuit is blanketed so that you can use this sensor competently with 5V good judgment and power. using the sensor is easy. for example, if you're the use of an Arduino, certainly connect the VIN pin to the 5V voltage pin, GND to ground, SCL to I2C Clock (Analog five) and SDA to I2C facts (Analog four). Then download our BMP085/BMP180 Arduino library and example code for temperature, strain and altitude calculation

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BH1750 LIGHT SENSOR:

Descriptions BH1750FVI is an digital Ambient Light Sensor IC for I2 C bus interface. This IC is the most suitable to obtain the ambient light data for adjusting LCD and Keypad backlight power of Mobile phone. It is possible to detect wide range at High resolution. (1 - 65535 lx).

Features:

1) I2 C bus Interface (f / s Mode Support)
2) Spectral responsibility is approximately human eye response
3) luminance to Digital Converter
4) Wide range and High resolution. (1 - 65535 lx)
5) Low Current by power down function

BH1750LIGHT SENSOR

Applications:

Mobile phone, LCD TV, NOTE PC, Portable game machine, Digital camera, Digital video camera, PDA, LCD display

RAIN SENSOR

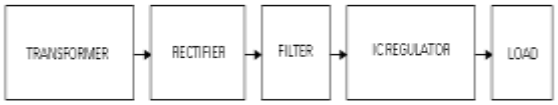
A rain sensor or rain switch is a switching device activated by rainfall. There are two main applications for rain sensors. The first is a water conservation device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall. The second is a device used to protect the interior of an automobile from rain and to support the automatic mode of windscreen wipers.

- It is used in smart irrigation system.
- It is also used as an irrigation monitoring quadcopter**.**

RAIN SENSOR

POWER SUPPLY CIRCUIT

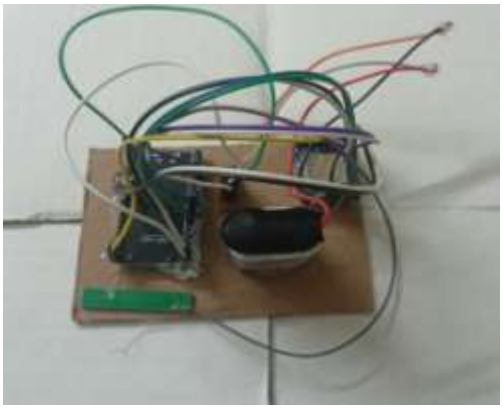
As in below figure this circuit is an approach to obtain both 12V and 5V DC power supply. The circuit uses two ICs 7812(IC1) and 7805 (IC2) for obtaining the required voltages. The AC mains voltage will be stepped down by the transformer T1, rectified by filtered by capacitor C1 to obtain a steady DC level .The IC1 regulates this voltage to bridge B1 and obtain a steady 12V DC. The output of the IC1 will be regulated by the IC2 to obtain a steady 5V DC at its output. In this way both 12V and 5V DC are obtained. Such a circuit is very useful in cases when we need two DC voltages for the operation of a circuit.



BLOCK DIAGRAM OF POWER SUPPLY

V.RESULT

TRANSMITTER DEVICE



RECEIVER DEVICE

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Weather conditions being displayed in a web page

The output is displayed in a web server page

The Project is successfully implemented and we have obtained the values ofTemperature, Humidity, Pressure, Altitude, Dew point, Rainfall, Lightand we have got a brief report of weather.

VI. CONCLUSION

This project aim is to measure the various parameters like Temperature, Pressure, Rain fall and level, light intensity, and continuously monitor. The data can be sent on web Server, which can be used to forecast weather and eventually analyze climate patterns, as well as for other meteorological purposes. The system uses a good combination of analog and digital sensors in wire and wireless mode of operation. Thus, a proof of concept for an Internet of Things device for a weather monitoring system has been established.

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