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Wireless Sensor System for Body Area Climate and Air Quality Monitoring By Using Lora Technology

Hamsathvani.P*, Kamali.A**,Kanimozhi.R***,Mary suji Mol.J****

*(Department of ECE, Jeppiaar SRR Engineering College, Chennai,TamilNadu
Email: hamsathvani98@gmail.com)
**(Department of ECE, Jeppiaar SRR Engineering College, Chennai,TamilNadu
Email: kamaliarul85@gmail.com)
***(Department of ECE, Jeppiaar SRR Engineering College, Chennai,TamilNadu
Email: kanirajece@gmail.com)
****(Department of ECE, Jeppiaar SRR Engineering College, Chennai,TamilNadu
Email: rsujimol84@gmail.com)

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Abstract:

Poor air quality is among the highest environmental public health risks and significant amount of costs and productivity losses are considered to be associated with poor indoor air quality. Air quality is extremely difficult for citizenry to feel or sense in order that most of the people cannot tell whether or not air quality is bad. Meanwhile, most of the prevailing air quality measurement devices are designed for professionals; they're expensive and beyond the reach of average users. during this paper, we present the Air Sniffer, a sensible phone-based sensor system, which may be conveniently used for private body area micro-climate monitoring. The sensor node is implemented with a well-liked Arduino prototyping board, a LoRa module, and variety of low-cost micro sensors..

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I. INTRODUCTION

Air pollution has become a threat to the person because it contains harmful gases from various sources. Exposure to pollution in open areas accounts for about 3 million deaths per annum , and indoor pollution can cause an equivalent number of deaths. In 2012, indoor and outdoor pollution was estimated at 6.5 million deaths (11.6% of the planet total). 90 per cent of deaths from pollution in low- and middle income countries cause two out of three deaths in South-East Asia and therefore the Western Pacific. pollution causes health risks, including disorder , stroke, carcinoma and respiratory infections consistent with world health organization . Malaysia is one among the emerging countries in Southeast Asia facing the challenges of pollution like other countries within the world. Among the factors that have led to increased pollution in Malaysia are industrial growth, construction, forest, fires, car fumes and transport, also because the problem of fog and smoke from the southwest monsoon of forest fires in Indonesia . Air is spread with harmful contaminants like carbon monoxide gas , CO_2 and nitrogen oxides and is spread both within the open environment and therefore the closed environment. Hence, the importance of the planning of the air quality measurement system is flexible and expandable to live pollutants both within the open or closed environment and supply the user with the worth of the pollution existing in one place or several places at an equivalent time.

II.EXISITING SYSTEM

it's documented that poor air quality may cause increased short-term health problems like fatigue and nausea also as chronic respiratory diseases,

heart disease , and carcinoma. Annual costs and productivity losses in US is estimated to be about $10 to $20 billion that are associated with sick building syndrome. The sick building syndrome is defined to elucidate acute health and discomfort effects that appear to be linked to poor indoor air quality and thus the time spent during a building.
The sensor node are often paired with a sensible phone through Bluetooth connection and therefore the Air Sniffer App running on the phone can poll data from sensor node periodically or on demand.

III.PROPOSED SYSTEM

The sensor system is meant by integrating a low-power microcontroller (MCU), various micro gas and climate sensors, and a LoRa module. Typically, sensors and may be connected to plain serial communication interfaces like SPI. Important design requirements for sensor system include battery-powered, low-power, and little size among others. the tiny sensor system are often carried easily by users, for instance , on a key chain, to watch micro-climate conditions round the user wherever the user goes.

• When sensor data are continuously uploaded onto a cloud storage system, the info are often made available to access not only on the user’s , but also from computers and smart devices . After collecting data for an extended period of your time for a gaggle of users, it's also possible for medical researchers to cross-correlate users’ health conditions statistically with the climate and air quality conditions that they need experienced over the time.

After collecting data for an extended period of your time for a gaggle of users, it's also possible for medical researchers to cross-correlate users’ health conditions statistically with the climate and air quality conditions that they need experienced over the time. Therefore, such a system can potentially enable new research direction in the health and medical research field.

IV.LORA TECHNOLOGY INTERFACING

It is expected that by 2020 we'll have 25 Billion devices connected to the web . to offer you a thought that's quite 3 times the population of earth today. With the concepts of IoT and Industry 4.0, Connected Vehicles and Smart Cities spreading rapidly, this is often presumably to happen. We have already got a couple of wireless protocols like BLE, Wi-Fi, Cellular etc, but these technologies weren't ideal for IoT sensor nodes since they needed to transmit information to long distance without using much power. This cause the increase of LoRa Technology, which may perform very-long range transmission with low power consumption.

The term LoRa stands for Long Range. it's a wireless frequency technology introduced by a corporation called Semtech. This LoRa technology are often wont to transmit bi-directional information to long distance without consuming much power. This property are often employed by remote sensors which need to transmit its data by just operating on alittle battery.

Typically Lora are able to do a distance of 15-20km (will talk more on this later) and may work on battery for years. Remember that LoRa, LoRaWAN and LPWAN are three different terminologies and will not be confused with each other . we'll discuss them briefly later during this article.

V. LORA SX1278 WITH ARDUINO

Enough theory lets actually build it ourselves and check how it's working. we'll use Arduino Uno at transmitter side and Arduino Nano at receiving side.

The LoRa module that i'm using here is that the SX1278 Ra-02 which operates on 433MHz. i'm from India and here the unlicensed Frequency range is from 865MHz to 867MHz, so i'm not legally allowed to use the 433MHz frequency module for an extended time aside from for educational purpose. LoRa modules do are available different frequency ranges, the foremost common being the 433MHz, 915MHz and 868MHz. The frequency at which your module works are becoming to be mentioned at the rear of the module. Also you'll either buy LoRa as a module or simply the chip. If you are going to urge only the chip then confirm your soldering skills are good since its a fragile job to solder wires to the LoRa chip. I even have both the Module and Chip version soldered with wires as showm below.

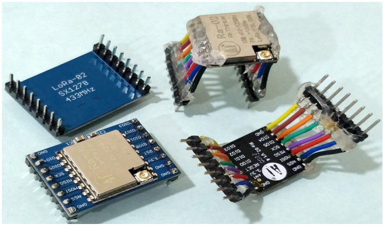


Fig 8:Lora Chip

Next important thing to possess in conjunction with your LoRa module is your Antenna. i'm employing a 433Mhz Lora module so my antennas also are rated for 433MHz, you've to pick your antenna accordingly. My LoRa module in conjunction with antenna is shown below.

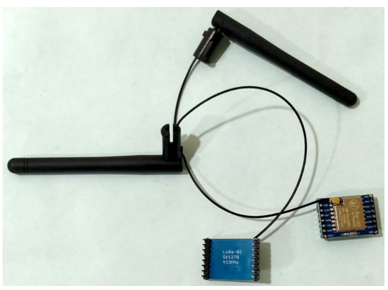


Fig 9:Transmitting Side- Connecting LoRa SX1278 with Arduino UNO

The LoRa module consists of 16 pins with 8 pins on all sides . Out of those 16 pins, six are employed by GPIO pins starting from DIO0 to DIO5 and 4 are employed by Ground pins. The module operates in 3.3V and hence the three .3V pin on LoRa is connected to the three .3v pin on the Arduino UNO board.

I have used connecting wires to form my connection between Arduino UNO and LoRa Module. The setup looks something like this shown below. the entire set-up can is powered by an influence bank to form it portable to ascertain the range.

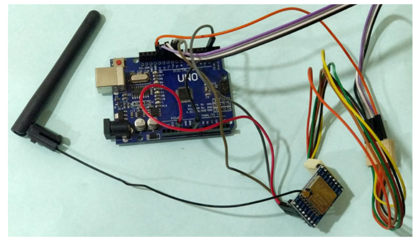


Fig 10:Receiving Side- Connecting LoRa SX1278 with Arduino NaNO

For the Receiving side we'll use an Arduino Nano with LoRa module. you'll use any Arduino board that you simply simply simply have for transmitter and receiver, but confirm you connect them accordingly. The circuit diagram to attach the Arduino Nano with LoRa is shown below

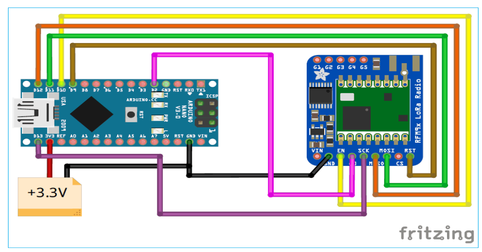


Fig 11:Transmitting side-Interfacing of LORA and ARDUINO

The connections almost remain an equivalent apart from one subtle change. The 3.3V pin of the LoRa module isn't powered by the Arduino Nano but with an external 3.3V regulator. this is often often often because the on-board regulator on Arduino Nano cannot provide enough current for the LoRa module to work . aside from this the connections remain an equivalent . i'm also pasting a consistent table below for your reference.

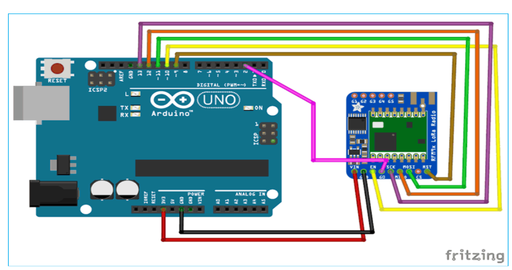
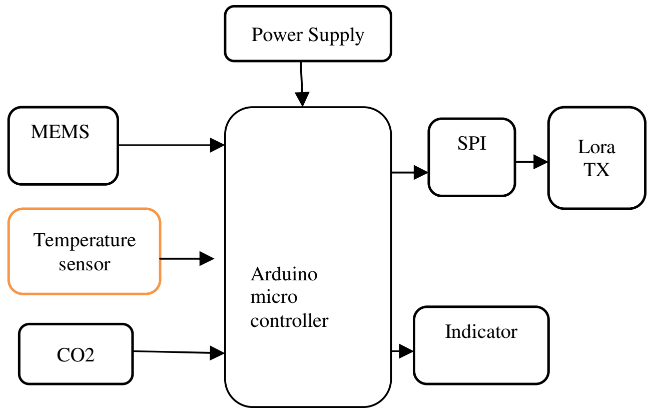
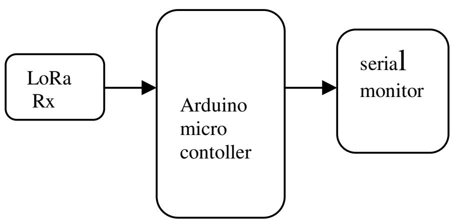


Fig 12: Receiving side –Interfacing of LORA and ARDUINO

VI.BLOCK DIAGRAM
Transmitter Section



Receiver Section



VII.TYPES OF SENSORS

GAS SENSOR:

Gas sensors are available in wide specifications counting on the sensitivity levels, sort of gas to be sensed, physical dimensions and various other factors. This Insight covers a methane gas sensor which will sense gases like ammonia which could get produced from methane. When a gas interacts with this sensor, it's first ionized into its constituents and is then adsorbed by the detector .

CO2 SENSOR:

It can detect CO-gas concentrations anywhere from 20 to 2000 ppm.It make detection by method of cycle high and coldness , and detect CO at coldness .It make detection by method of cycle high and coldness ,and detect CO when low temperature(heated by 1.5V).The sensor conductivity is more higher among with the gas concentration raising.

VIII.CONCLUSION :

Garbage management using Lora communication has been done with the Arduino micro controller and with the supported pheripharls. The output has been demonstrated and verified in the serial monitor of the microcontroller.

IX.REFERENCE:

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