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# AIR MONITORING AND DATA ACQUISITION SYSTEM

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**ABSTRACT:** Atmosphere surrounds the earth. All the living beings are surrounded by the atmosphere .So we need to measure different parameters of atmosphere which have the impact on human health. The various parameters include the atmospheric pressure, humidity and various gases. This project is a simple wireless sensor based air quality monitoring and data acquisition system for industrial and urban areas. The framework comprises of temperature sensor, humidity sensor, pressure sensor and a set of gas sensors (like carbon monoxide, smoke). In case of unexpected values the system sets the buzzer on. Wireless transmission is efficient technology which can accumulate and measure parameters from real world.

KEYWORDS: Wireless sensor, air quality monitoring

## **1. INTRODUCTION**

Life of the human beings follows the "Theory of Evolution" given by Charles Robert Darwin. Life is all about survival of human race we require a quality of environment to live in. As we all are very much familiar about the day to day increment of pollutants in our environment we need to keep check on it. There are many health disorders which occur to the living organism due to little or more ups and down in the amount of different environmental components especially in air. So we need to measure different gasses.

The WHO states that 2.4 million people die each year due to air pollution with 1.5 million of those death attributes the indoor air pollution. Therefore it's a necessity to establish this system on public places on large scale due to ever increasing air pollutants.

Nevertheless there are other parameters like temperature, pressure and humidity also which plays a vital role in the selection of the locality for different business purposes like agriculture, factory setup etc.

By turning this wireless, we get different benefits. There will be no need for the person to be present physically at the site, this reduces the risk on his/her health.

So, in this project we are designing a wireless [RF Module] based system to measure these parameters related to the two different areas.

## 2. HARDWARE ARCHITECTURE

The microcontroller at the transmitter end read the values of the temperature sensor, humidity sensor, pressure sensor, CO sensor and smoke sensor. Fig 1 is the basic block diagram of the transmitter end of the system.

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Fig 1: BLOCK DIAGRAM OF THE TRANSMITTER END

The sensors acquire the parameters in the real time and the parameters are processed by the microcontroller and the output is displayed on LCD. Fig 2 is the basic block diagram of the receiver end of the system.



Fig 2: BLOCK DIAGRAM OF THE RECEIVER END

# 2.1 MICROCONTROLLER

The powerful yet easy to program CMOS FLASH based 8 bit microcontroller packs Microchip's powerful architecture into 40 or 44 pin package and is upwards compatible with PIC16cfx.The PIC16F877A EEPROM data memory is of 256 bytes, self programming an lcd,2 comparators,8 channels of 10 bit analog to digital converters, the synchronous serial port can be configured as either 3 wire serial peripheral interface(SPI) or the 2 wire Inter integrated circuit(I2c) bus and a Universal Asynchronous receiver transmitter(USART).All of these features make it ideal for more advanced level of A/D applications in automotives, industrial appliances and consumer appliances.

# AVR ATMEGA328P MICRO-CONTROLLER:

It provides an 8 bit RISC performance, unifies 32KB ISP flash memory alongside the read-whilewrite capabilities, 2KB SRAM, 1024B EEPROM, 32 general purpose working registers, 23 general purpose I/O lines, 3 flexible timer/counters having compare modes, internal as well as external interrupts, serially programmable USART, TWI i.e. a byte-oriented two wire interface, SPI serial port, a 6-channel 10-bit Analog/Digital Converter.

# 2.2 PRESSURE SENSOR

The BMP180 measures in the range of 300 to 1100 hPa .The accuracy down to 0.02 hPa in advanced resolution mode. For high accuracy, ruggedness and long term stability it is based on piezo-resistive technology. These come factory-calibrated, with the calibration coefficients already stored in ROM.

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## **2.3 HUMIDITY SENSOR**

Humidity is the presence of water in the air. The presence of water vapour also influences various physical, chemical and biological processes. Controlling or monitoring humidity is of paramount importance in many industrial and domestic applications and many others, humidity sensors are employed to provide an indication of the moisture levels in the environment. The DHT11 is a ultra low-cost humidity sensor. It uses a capacitive humidity sensor and a thermostat to measure the surrounding air, and gives a digital signal on the data pin.

### 2.4 SMOKE SENSOR

Smoke is a collection of airborne solid and liquid particulates and gases emitted when a material undergoes combustion together with the quantity of air that is entrained or otherwise mixed into the mass. For the measurement of the amount of smoke we use MQ-2.

### 2.5 CO SENSOR

Carbon Monoxide is one of the most harmful gasses present in the atmosphere. It is colourless, odourless gas. It affects the cardiovascular and nervous system. A little increment in its amount can cause a vital effect on the human. To measure this we use MQ-7.

#### 2.6 RF MODULE

An RF Module is a (usually) small electronic circuit used to transmit, receive, radio waves on one of a number of carrier frequencies. They are used over remote controls as it doesn't require the line-of-sight operation. This process reduces paper, data entry time delays, cycle count processing, out of stock quantities and typing errors. Here we are using the frequency of 434 MHz.

#### 2.7 TRANSMITTER CIRCUIT DIAGRAM

The Transmitter End in the main comprises of a set of sensors which are interfaced with the effectually working AVR ATMEGA328P Micro-controller, which thereby is interfaced with the RF Transmitter module.



Fig 3: CIRCUIT DIAGRAM OF TRANSMITTER END

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# 2.8 RECEIVER CIRCUIT DIAGRAM

The frequency of RF module is 434MHz. LCD is connected to port B of the microcontroller. Potentiometer is connected to the VEE pin of LCD. It is used to control the brightness of the LCD. Pin 26 of microcontroller is connected to the RF receiver to receive the data. The buzzer is set on when the values exceed the predefined limits which varies according to the surroundings.



Fig 4: CIRCUIT DIAGRAM OF RECEIVER END

## 3. SYSTEM ANALYSIS

- 1) At the outset, a POWER SUPPLY of 5v is given using the BRIDGE RECTIFIER and the Step down Transformer.
- 2) To maintain a fixed voltage of 5v, IC 7805 VOLTAGE REGULATOR is taken into consideration.
- 3) The various analog as well as digital inputs are given to the AVR ATMEGA328P Micro-controller. To be specific, only the BMP180 Temperature-Pressure sensor considers digital input, while the rest of the sensors i.e. DHT11 Humidity sensor, MQ2 CO sensor and MQ7 smoke sensor work upon the analog signals from the surrounding atmosphere.
- 4) All the analog sensor inputs are further converted into the digital form using the A/D Converter pin(here PIN A0, A1, and A2) of the micro-controller. The ATMEGA328P runs at a fixed predefined frequency of 16MHz. These digitally converted sensor values are hence transmitted to the RF Transmitter Module.
- 5) A frequency of 434MHz is fixed for the transmission of the data to the RF Receiver end.
- 6) Finally, the above quoted micro-controller is interfaced with a 16\*2 LCD Screen, such that the output can be digitally recorded.
- 7) In case any of the specified sensors' happens to go out of the explicit range predefined in the code, the alarm is interfaced with PIC 16F877A micro-controller to buzz as and when required.

## 4. RESULT

The result for the entire system of Air Monitoring and Data Acquisition System can be consummated as follows:

## 4.1 LIQUID CRYSTAL DISPLAY

Outputs in the digital format for various sensors can be recorded.

## 4.2 BMP 180 TEMPERATURE- PRESSURE SENSOR

The BMP180 is a high-precision, ultra-low power digital barometer. It offers a measuring range with an absolute accuracy of down to 0.02 hPa.

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### www.ijesrr.org 4.3 DHT 11 HUMIDITY SENSOR

DHT11 is a digital temperature & humidity sensor providing a calibrated digital signal output.

## 4.4 MQ2 SENSOR

MQ2 comprises of SnO2 as a sensitive material, due to which it very efficiently measures the amount of smoke present in any particular location.

## 4.5 MQ7 SENSOR

This sensor has quite a high sensitivity and a very quick response time.

INPUTS	PARAMETER	STANDARD	THRESHOLD
SENSORS USED	BEING	RANGE	RANGE FOR
	MEASURED	FOR	ALARM
		OUTPUT	BUZZER
BMP 180	Temperature	300-1100hPa	
	and Pressure	-45 to +85	45 Degree
		Degree	Celsius
		Celsius	
DHT 11	Humidity	20% TO	30% RH
		90% RH	
MQ2	Carbon	100-	200ppm
	Monoxide	10000ppm	
MQ7	Amount of	20-2000ppm	200ppm
	Smoke		

## TABULAR ANALYSIS

## **5. CONCLUSION AND FUTURE WORK**

This project measures the temperature, pressure, humidity, smoke and amount of CO in the atmosphere. This helps us to know the atmospheric balance at different places. In most of the sub urban areas we need this technology to keep check on these parameters as well as in the buildings. The wireless system makes this project more users friendly. For the future aspects we can increase the range.

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