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Design and Development of Indoor Air Quality Monitoring System using Environmental Digital Sensor - BME680

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***Abstract*— In present scenario the air was much polluted and in turn harms the health of the living beings in the society. Then we know by using burning of plastics and using more vehicles are causing polluted air in outdoor section then by this it may causes more health issues then what the scenario happens it in indoor section also which the situation we are not able to live comfortably in our homes also then we will going to face the situation of buying the quality of air also to overcome that situation. We can say we can buy anything by the money what going to happen if air also polluted that air also we need to buy for money then in world money plays vital role then life of a human then to overcome this situation we are monitoring the quality of air in indoor section with Arduino and BME680 sensor parameters like "Temperature", "Humidity", "Pressure", "Altitude", "Calibrated Altitude", "Gas resistance" on LCD.**

***Index Terms*— BME680, Arduino, weather monitoring system.**

I. INTRODUCTION

This is used to indicate the parameters of temperature, humidity, pressure, gas resistance, altitude, calibrated altitude in indoor section. Every where the air was polluted if the air also polluted in indoor section what effects we need to face the health problems and we mostly spend of our time. If the air was polluted, we need to different diseases which effects human life. According to the world health organization is responsible for the deaths of 3.8 million people annually different pollutant gases can be produced indoor section due to cooking, smoking, use of electronic machines, use of customer products and different harmful pollutants.

The normal humans can intake some pollutants but the amount of some pollutants cannot be taken by old age people and children where capability of gasping air changes then which leads to the lots of health issues where ability to fight against them is less. Most of us uses air conditioner for cool air but it also consists of lots of pollutants which harms of our health condition. It can also used in seminar halls, bars where people used to smoke and pollute the air which effects of our health conditions then we used to consume the polluted air which causes health issues and damages our health and also using doom stick which used to pray the god in temples as a closed rooms also consists of chemical gases which harms in healing the air the lighting of doom stick should be in limited way which in turn not effecting our health conditions

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In indoor stadium also we can check the quality of air where people of participating in games for concentrating the game perfectly they need to get fresh air which helps in concentrating the game. we also protect our pets in indoor section then we can say by our talks an can say for fresh air but for pets it cannot be possible then quality of air should be maintained.

II. Literature Survey

1.this article was presented for monitoring of air quality parameters and conducted in classrooms of teaching.2.this section helps we mostly spend of our times of indoor section this was conducted in homes whose effected with pollutants like smoking, cooking and different products.3.while constructing the building the construction material consists of pollutants material.4.green house applications as a collection of harmful chemicals which causes eye diseases, cough and even health also effects.5.keep the good environment in hospital is a duty of nurse keeping the environment which can be in operating room, and tested in hospital for proper environment conditions.6.the air pollution was done research by the members and done the testing in laboratories.7.this conducted in seminar halls and large halls and in industry inside for meeting were measured for quality of air.

III. Proposed Methods

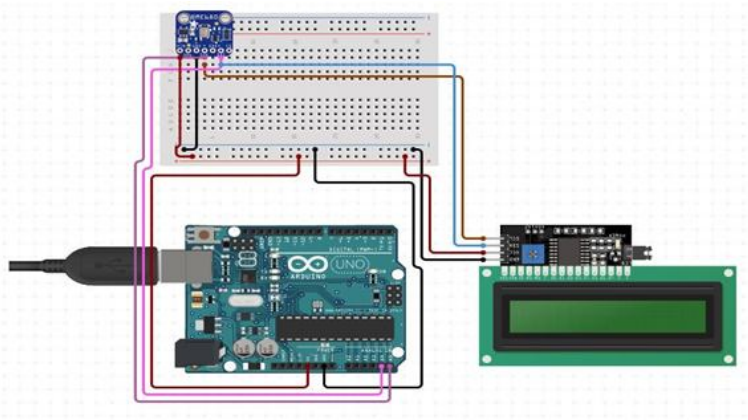

Fig: 1. Circuit Diagram of Indoor Air Quality Monitoring

The above circuit shows an environmental sensor which is BME 680. It consists of 4 pins. VCC, GND, SCL, SDA. The VCC pin of BME 680 connected to the VCC of Arduino. The GND pin of BME 680 is connected to GND pin of Arduino. The SCL pin of BME 680 is connected to analog pin(A5), then SDA pin of BME 680 is connected to analog pin (A4). The code analyzed is dumped to the Arduino. Then the LCD is connected to Arduino using I2C. The pin configuration is mentioned above. The according to the given connections, the circuit is placed in a room. The BME 680senses the given parameters in the code such as Temperature, Pressure, Humidity, Gas Resistance, Calibrated Altitude, Altitude can be displayed on the LCD Display with reading values.

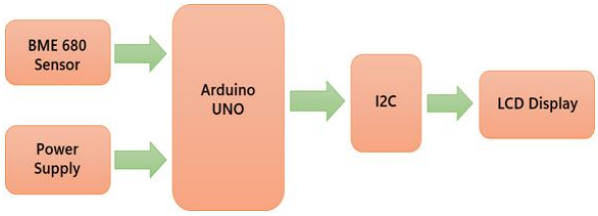

Fig: 2 Block Diagram of Indoor Air Quality Monitoring

The BME 680 is the environmental sensor used to sense the parameters such as Temperature, Pressure, Gas Resistance, Humidity, Altitude, Calibrated Altitude. This BME680 Sensor consists 2.54 pin/female and SPI connectors with integrated voltage regulator and simple in usage.
The sensed parameters are given to the Arduino UNO by turning on the power supply. Open-source electronic prototyping platform enabling users to create interactive electronic objects. The Arduino uno consists 32 pins of ATmega328p microcontroller with an operating voltage of 5v and clock speed of 16 MHz and for connecting as

controller where it need to contains the memory space which is of 32kb of flash memory and 2kb SRAM and EEPROM of 1kb.
We used to assign the inputs for input pins where it contains 30 input output pins in that it contains 24 digital input output pins and 6 analog input pins and communication interface, we used i2c.
Sensed parameters of BME 680 can be displayed in LCD. The term LCD stands for liquid crystal display. It is a type of electronic display used for indication used in different applications in TVs, laptops etc.i2c is used for interfacing to connect the Arduino with LCD it contains 16 pins where we use 16x2 display where contains 16 rows,2columns with 32 characters which contains 8 data pins.

Pin1-gnd pin
Pin2-vcc
Pin3 -control pin
Pin4-register select
Pin5-read/write
Pin6-enable pin
Pin7-14 -data pins
Pin15- positive led
Pin16 – negative led.

TABLE I. COMPARISON BETWEEN DAY TIME AND NIGHT TIME READINGS

S.No	Parameters	Readings (Nighttime)	Readings (Day Time)
1	Humidity(%rh)	46. 06.00	53.22.00
2	Temperature(C)	24.37900	28.65802
3	Calibrated Altitude(m)	522.4000	468.2036
4	Altitude(m)	269.3200	267.2580
5	Gas Resistance(ohm)	41978.00	40256.00
6	Pressure(Pa)	98290.00	97992.00

TABLE II. COMPARISON BETWEEN A CLOSED ROOM WITH COOLING, WITHOUT COOLING AND OPEN WORK PLACE

Parameters	Readings (Seminar Room)	Readings (Workplace)	Readings (Closed Rooms With Cooling)
Humidity(%rh)	40	39	34
Temperature(C)	50	60	22
Calibrated Altitude(m)	521	700.2	555
Altitude(m)	400.5	500.2	522.8
Gas Resistance (ohm)	65235	80348	25471
Pressure(Pa)	76250.23	50330.15	97483.00

When the supply is given to the Arduino UNO and the BME680 delivers outstanding environmental measurement performance enabled by internal compensation algorithms and precise factory calibration of its altitude, gas resistance, pressure, and temperature and humidity sensors. Hence, it senses the parameters and shows the readings on LCD display.

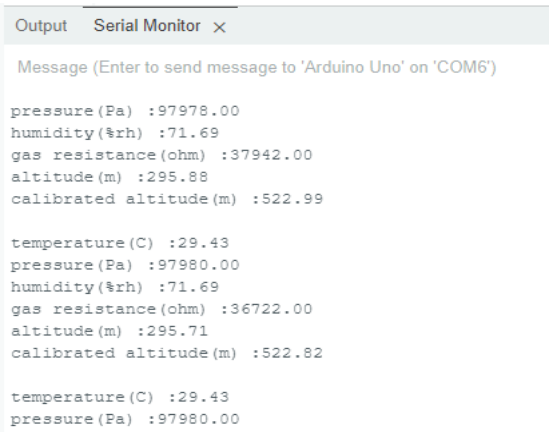

Fig 3. Serial Monitor outputs

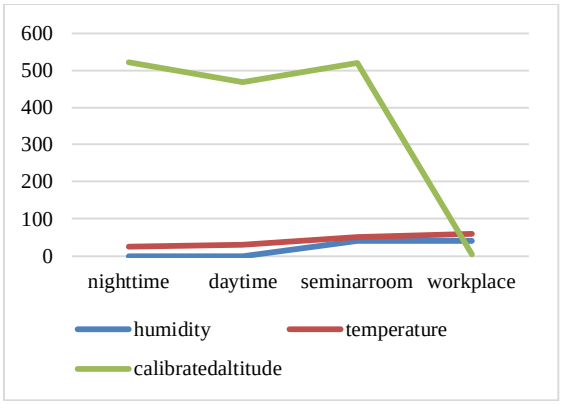

Fig4. Humidity vs Temperate

In the above can be splinted into 2 graphs where in graph we represented humidity, temperature, calibrated altitude in night time, daytime, seminar room, workplace in one graph where represented in plotting form.

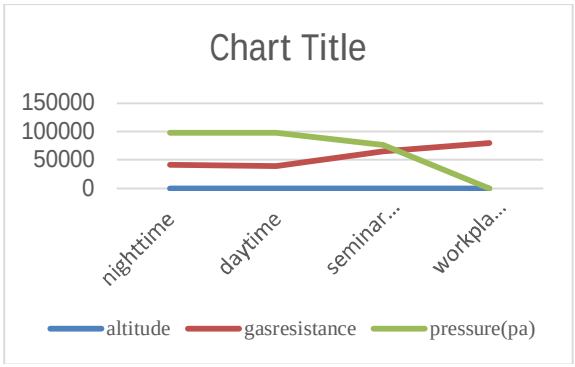

Fig5. Altitude Vs Gas resistance

In another graph represented altitude, gas resistance, pressure in night time, daytime, seminar room, workplace are represented in one graph

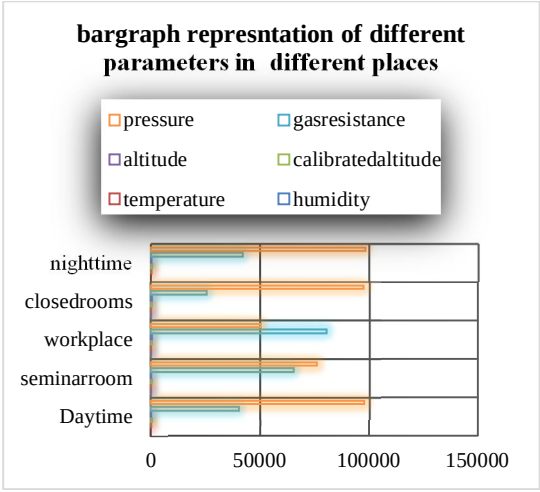

Fig6. Environmental parameters

The above bar graph represents the with different colors can be indicated for environmental parameters such as humidity, temperature, calibrated altitude, altitude, gas resistance, pressure in different places in different durations of time that values of readings is indicated .According to graph highest humidity can be recorded in daytime, temperature higher amount can be recorded in workplace, calibrated altitude also recorded higher in workplace, higher altitude recorded in closed rooms with cooling, higher gas resistance is recorded in seminar room, lastly higher pressure readings in day time as per above graph.

Fig 7 Prototyping Model

IV. PROTOTYPES OUTPUTS

Fig 8 Humidity value readings

Humidity specifies the quantity representing the amount of water where a human can comfortable with 30 to 60 percent indoor section.

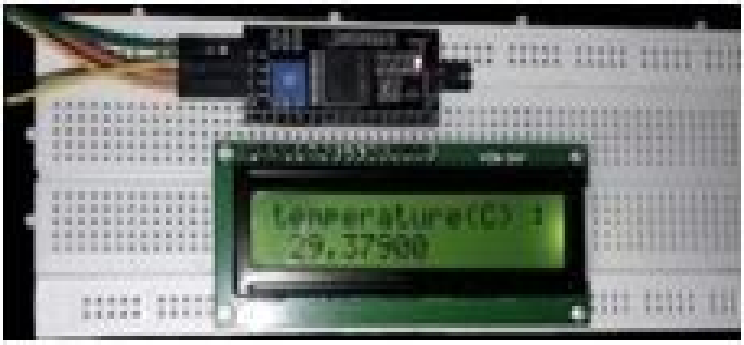

Fig. 9. Temperature value readings

Maximum temperature at which human can survive is 108.14 degree Fahrenheit or 42.3 degree Celsius. By high temperature causes damage to the human brain.

Fig. 10. Calibrated Altitude value readings

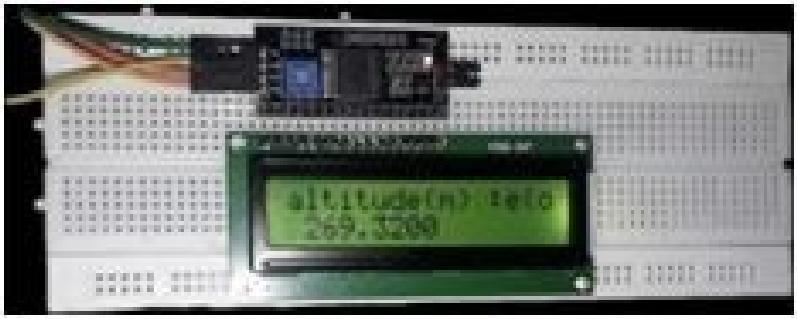

Fig. 11. This reflects the air craft's altitude above sea level and incorrect for local pressure.

Fig.12. Altitude value readings

The height of an object or point in relation to sea level or ground level. There causes headaches and dizziness by crossing the range. (About 8,000 meters/26000 feet).

Fig.13. Gas Resistance value readings

In the resistance stage blood pressure and heart rate of our body should be reduced.

Fig.14. Pressure value readings

The maximum pressure 6.3kpa for survival of human body.

V. HARDWARE COMPONENTS

A. Aurdunio uno

It acts as a controller used for collecting data make that to be processed. it consists of 32bits.where we use our brain for controlling the actions of humans where we feel brain works a key role for every action and response.in that same way the Arduino used to control the operation.

B. BME680

Bme680 is a type of sensor which is used to measure the parameters such temperature where how much heat is present in our surroundings, Readings of a pressure where physical force applying continuously where it can measured in pascal(pa),humidity used to measure the level of water content measured in percentage of relative humidity(%rh),gas resistance can measured in ohm of ranging 50 to 50,000 ohm, altitude used to measure the height of an object from ground level where we usually prefer height to measure in meters using of altimetry we can also measure the altitude. We mostly prefer the units of hectopascals(hpa).

C. LCD with I2C

I2c stands for inter integrated circuit is used to act as a interface between Arduino and lcd because we cannot connect directly the output of Arduino to the LCD where occurrence in mismatching in taking the input where for taking the parallel data into serial change in data transfer. Liquid crystal used for displaying the output of the process for visual purpose where we use our tv, monitors for good visuals and in the same to check the output of the circuit with proper notifiable values we used LCD for displaying the output.

Software requirement:

We used to execute the software by using the Arduino IDE using embedded c language these helps us in provide the good structure of the code to run the hardware components in embedded system there is requirement of program with proper internet connection we can execute the program.

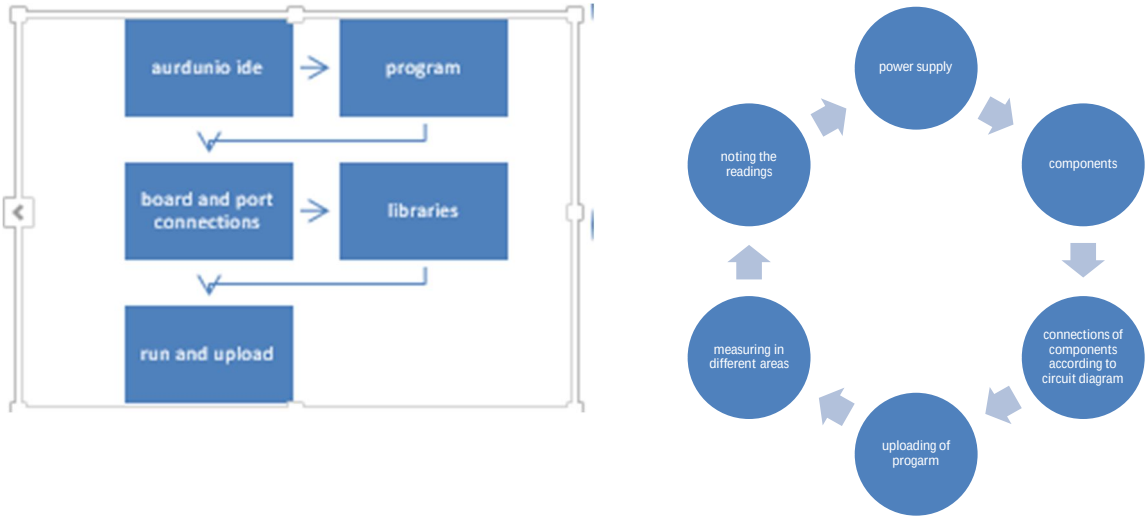

Fig.15 flow diagram of proposed method

VI. CONCLUSION

From this project we had concluded that in air has a different pollutant to secure of our life from different health issues we prefer mostly of our time in indoor section then in this project we measured some parameters of air like temperature, humidity, gas resistance, pressure, altitude, calibrated altitude which helps of our required quantity of human consumption. The indoor air quality is a significant factor in maintaining good health. Understanding of the harmful effects induced by indoor air pollution will help us to take all the appropriate preventive measures to reduce the possible health risks. There are lots of solutions for getting the quality of air and to overcome from the polluted air and protecting our health from hazardous conditions but there will be problem of economy and cost perspective and easy access , installation and construction that will simple by our product and which is of real time monitoring system which reduces risk of health issue and identify the quality of air where need to improve the situations make the innovative things for securing our health conditions.

REFERENCES

[1] N. Marchetti, A. Cavazzini, L. Pasti, M. Catani, C. Malagù and V. Guidi, "A campus sustainability initiative: Indoor air quality monitoring in classrooms," 2015 XVIII AISEM Annual Conference, Trento, Italy, 2015, pp. 1-4, doi: 10.1109/AISEM.2015.7066774.

[2] Assessment of exposure to indoor air pollutants. WHO Reg Publ Eur Ser. 1997;78:iii-xii, 1-139. PMID: 9587245.

[3] Mannan M, Al-Ghamdi SG. Indoor Air Quality in Buildings: A Comprehensive Review on the Factors Influencing Air Pollution in Residential and Commercial Structure. Int J Environ Res Public Health. 2021 Mar 22;18(6):3276. doi: 10.3390/ijerph18063276.

[4] Baeza Romero MT, Dudzinska MR, Amouei Torkmahalleh M, Barros N, Coggins AM, Ruzgar DG, Kildsgaard I, Naseri M, Rong L, Saffell J, Scutaru AM, Staszowska A. A review of critical residential buildings parameters and activities when investigating indoor air quality and pollutants. Indoor Air. 2022 Nov;32(11):e13144.

[5] TSI, Indoor Air Quality Handbook. 2013.

[6] Saini, J., Dutta, M. & Marques, G. A comprehensive review on indoor air quality monitoring systems for enhanced public health. Sustain Environ Res 30, 6 (2020).

[7] González-Martín J, Kraakman NJR, Pérez C, Lebrero R, Muñoz R. A state-of-the-art review on indoor air pollution and strategies for indoor air pollution control. Chemosphere. 2021 Jan;262:128376.

[8] Indoor air pollutants. A literature review by TF Cooke · 1991

[9] Indoor air quality in public utility environments by M Śmiełowska · 2017 ·

[10] Indoor air quality and health by AP Jones · 1999 ·

[11] WHO Guidelines for indoor air quality by TED CHEMIC ·

[12] N. Umapathi, S. Teja, Roshini and S. Kiran, "Design and Implementation of Prevent Gas Poisoning from Sewage Workers using Arduino," 2020 IEEE International Symposium on Sustainable Energy, Signal Processing and Cyber Security (iSSSC), 2020, pp. 1-4, doi:10.1109/iSSSC50941.2020.9358841.

[13] Umapathi N., Sabbani S. (2022) An Internet of Things (IoT)-based Approach for Real-Time Kitchen Monitoring Using NodeMCU 1.0. In: Sivasubramanian A., Shastry P.N., Hong P.C. (eds) Futuristic Communication and Network Technologies. Lecture Notes in Electrical Engineering, vol 792. Springer, Singapore. https://doi.org/10.1007/978-981-16-4625-6_4

[14] N. Umapathi, C. Vyshnavi, K. Srilekha and V. Sahithi, "Monitoring of Crop Growth Parameters using Arduino and ESP8266," 2022 2nd International Conference on Emerging Frontiers in Electrical and Electronic Technologies (ICEFEET), 2022, pp. 1-5,

[15] Umapathi, N., Harshitha, P., Bhavani, I. (2023). An Internet of Things-Based Mining Worker Safety Helmet Using ESP32 and Blynk App. In: Singh, Y., Verma, C., Zoltán, I., Chhabra, J.K., Singh, P.K. (eds) Proceedings of International Conference on Recent Innovations in Computing. ICRIC 2022. Lecture Notes in Electrical Engineering, vol 1011. Springer, Singapore.