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A Statistical Approach of Indoor Air Pollution Detection in USIC By ANOVA Method

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Abstract:
Indoor air pollution is the world largest environmental problem in the poor and developing countries like India because India having large number of village and urban areas within state areas. Most of village peoples are not using proper clean fuel for their cooking. The Indoor air pollution in urban areas is continuously increased for the past 3-years, which cause a health related problems like eye irritation, nose, headache, breathing problems and heart problems. The amount of air pollution in indoor is approximately 3 times higher than outside building air(Environment). This study is deal with analysis the indoor air pollution in USIC building in Madurai Kamaraj University campus, Madurai and to find out whether the air pollution is high or low as compared with Indian standard and WHO data reference. This will help to improve the in comfort working zone in this office, because the most of the time the students and staffs are in the class room, lab and office. The parameter taking into consideration are AQI, $PM_{2.5}$, Temperature and Humidity. With help of above parameters monitoring and proposed to control would leads to creation of smart class room inside the campus. For the past 2-years the elder staffs health in USIC were more affected without any reason. This present study also gives a solution to the indoor air pollution in USIC class room –MKU. The IOT based indoor air pollution and reporting system project used to give a real report and know the indoor air pollution condition at particular place /class room. Further one of popular the statistical method of analysis -ANOVA(Analysis of variance)test used, which was helped to find out the significance in concentration level of indoor air pollution parameters.

Keywords: Smart sensitivity sensor, compact sensor, data around world, mini future IOT sensor, polluted air level, pure air inside, dust air concentration, air significant

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I. INTRODUCTION:

The Madurai kamaraj University is the oldest university in Tamil Nadu state, India. The Madurai kamaraj University consist of 77 departments and 20 schools with covered an area of 750 acres. This is very close to NH85 highways form Madurai to Theni Main road. It is located in the urban area of Palkalai Nager, Madurai to Theni main road, Madurai-21. The location of MKU in the internet identification is located as latitude 9.94148 and longitude 78.008896 and GPS co- ordinates 9^0 56’ 29.1048” N and 78^0 0’ 32.0256 E. The study of indoor air pollution in this paper is mainly focus on USIC-building rooms to monitor and collect the data. The limitation of this study would lead to create a smart class room with zero pollution inside the working place.

The IOT based weather monitoring system was used to get a weather conditions at a USIC building rooms in MKU.[1] The weather monitoring systems normally having different types of sensors such as rain fall, wind speed and direction, temperature and humidity sensors.[2]The internet of Things(IOT) weather monitoring system given a solution to pollution free class rooms such as smart class rooms/office/home in the working environment.[3] The IOT is the future technology, which connect any type of instrument/ devices/ sensors with Arduino software application without any problem and communicate each other with help of internet data transfer facility.[4] The sensors normally given a output in the form of digital/analog form which was understood by Arduino Uno board advanced software arrangement.[5] If the building roof is made up of asbestos, then health related problems were occur due to indoor pollution. We must take care of all other indoor pollution parameters like carbon monoxide, Lead, Mold, Radon and volatile organic compounds (VOCs). So the AQI values of (0-500) and colour code indication depends on indoor air pollution inside the building.[6] The health related symptoms of headache, eye irritation, fatigue, dry throat, sinus congestion, dizziness and nausea were an indication of indoor air pollution in the working places.[7]

When we monitor the indoor parameters in a class room/ home continuously , then we can easily create a zero indoor air pollution in the working places by introducing more ventilation (by forced ventilation) in the building or fitting of more window openings along with the existing one.[8]

The air monitoring stations in India gives all information about emission of air pollutant in outside environment in a particular place, where the monitoring station is located.[9,10] The polluted air also contains some of the heavy metals like Ni, Cu, Pb.[11] The urban residential environment consist of NO_2 rich in some areas.[12] When the particulate(PM10) increases continuously it will affect the human health.[13]It consists of both fine and coarse dust particles which are called as suspended particulates matter(SPM).[14]. The fine particulate and dust involves in climatic conditional changes.[15]

II.METHODOLOGY:

2.1. Materials Required:

Indoor air pollution monitoring system needed a Arduino Uno board, smart sensors, open source Arduino Uno software and a laptop computer with network connection. The Prana Air smart sensor portable instrument also used to monitor some of the indoor air pollutant. The sample data were taken in USIC class room and lab in Madurai kamaraj university, Madurai by using a Laptop with an Arduino Uno board connection arrangement with necessary sensors. In this system three sensors (Temperature, Humidity and CO_2 sensor) were used in a bread board with Arduino Uno board connection. The Arduino Uno board module was connected to laptop through a USB port with a power supply of (+5V DC). The sensor output was displayed in a LCD display unit (16X2) or in the serial monitor in the computer. The smart indoor air quality monitors-1) PranaAir and 2) SMILDRIVE smart air quality monitor were used. This helps to monitor the indoor parameter continuously in a particular location.

2.2. Statistical Analysis methods:

In this study, the Statistical analysis of data was carried out with help of air pollution data variance of different indoor air pollution parameters. The following steps were carried out to calculate the significance level based on degrees of freedom of parameters by using a one way ANOVA single factor test/ ANOVA Two factor.

Step 1: The NULL hypothesis was framed first.

Let us Assume: All indoor (parameters) variable mean values are equal or Same for (1 to n- groups)

$H_o= \mu1=\mu2=\mu3=\mu4=\ldots\ldots\ldots\ldots..\mu_n$

Step 2: The condition for Alternate hypothesis is any one of the group mean is different from others (rest of the mean values) (or) all means are not equal.

$H_a= \mu1\neq\mu2\neq\mu3\neq\mu4\ldots\ldots\ldots\ldots..\mu_n$

Step 3: The correlation, regression, standard deviation, mean, Max value are obtained From Excel → Data→ Data analysis → Descriptive statistics tool Selection

Step 4: The ANOVA test output result was obtained by selection of tool in Excel

Excel → Data → Data analysis→ Single factor ANOVA selection

Step 5: The p-value was noted from the ANOVA table result. Similarly the value of F, $F_{critical}$, SS, df, and MS also noted for comparison

Step 6: Checking of the value of p:

if ($p< 0.05$) is true or false

Step 7: Checking of the value of result:

if ($F>F_{critical}$ value) is true or false

Step 8: If steps 6,7 are true, then

- {reject the NULL Hypothesis and accept Alternate hypothesis}

Step 9: If steps 6,7 are false then accept the NULL hypothesis and rejected the Alternate Hypothesis.

Step 10: significance level test:

Check the value : if ($p<0.05$) is true then -- {NULL hypothesis is rejected and variables are Said to be Significant between them}

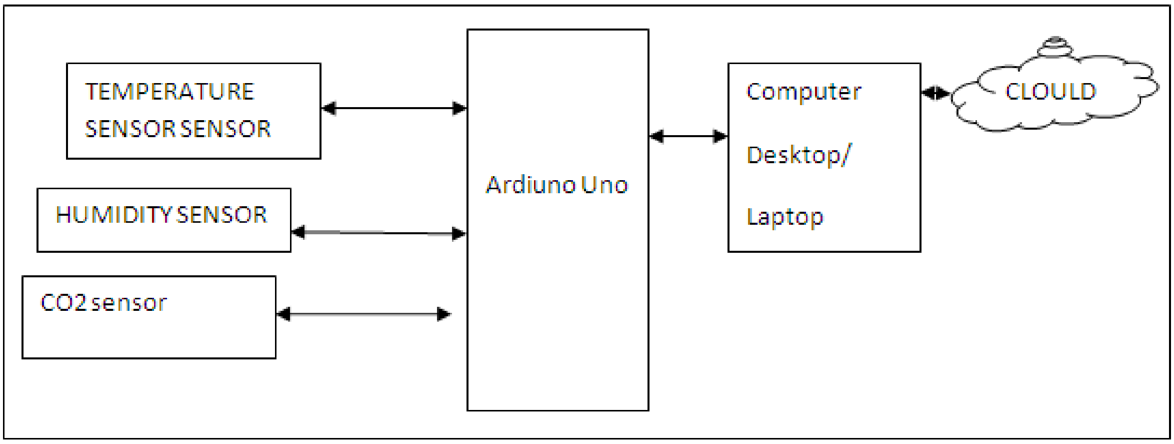
II.SYSTEM ARCHITECTURE:

3.1. The internet of Things (IOT) outline:

The Internet of Things(IOT) is the new technology developed recently with more facility because different types of devices are connected directly with Arduino Uno board. The Arduino Uno board connected to computer for power supply (+5V) connection through USB cable and sensor signals data are transfer to a computer for further processing , which having a Internet connectivity to transfer the data through a network.

Figure 1: Internet of thing data transfer stages:

3.2. SYSTEM DESIGN FOR INDOOR AIR POLLUTION:



Arduino Uno Board and its specification details:

Arduino Uno is open source software available in the Internet. It is a microcontroller with having inbuilt ADC. It is operated with +5V Dc voltage. The USB cable is used to connect the Arduino Uno Board with USB port of the system. It having 14 Nos. of I/O pins, 6-Analog pin, 3-Nos. of Ground pin and 6-Nos. of PWM pins are available in the board.

The board was activated by one power supply with 3.3V and another pin with 5V DC pin. Also one T_x and One R_x pin also available to communicate of data sending/receiving with Wi-Fi board or communicate with another Arduino Uno board that is board to board communication. In this system proposed model used with Arduino Uno board, Arduino software and hardware circuit for sensor and other connections.

3.3: SENSORS:

The system consists of CO_2, Temperature and humidity sensors. These sensors are used to measure the humidity, temperature and CO_2 level as a environmental parameter. The sensor outputs are in the form of analog voltage. The microcontroller in the Arduino Uno microcontroller will convert them into a Digital signal. These digital signals also available in the serial monitor as a graph of continuous data output. It is possible to store all the data in a Excel format sheet with help of special software PLX-DAQ Tag for future reference.

3.3.1: TEMPERATURE AND HUMIDITY :

The Commercial DHT11 sensor which is available in the market as a dual sensor type in a single unit(pack). The humidity sensor and thermistor are used to measure the quality of surrounding air and gives an digital output on digital pin in Arduino Uno Board. Some sensor not having the analog pins. The output may be obtained for every second based the program coding written (1000 µsec). The power supply required is 3-5V. It works well for the range of 20-80% humidity reading with 5% accuracy. The temperature reading is measured by this sensor in the range of 0-50℃ with +/-2 ℃ accuracy.

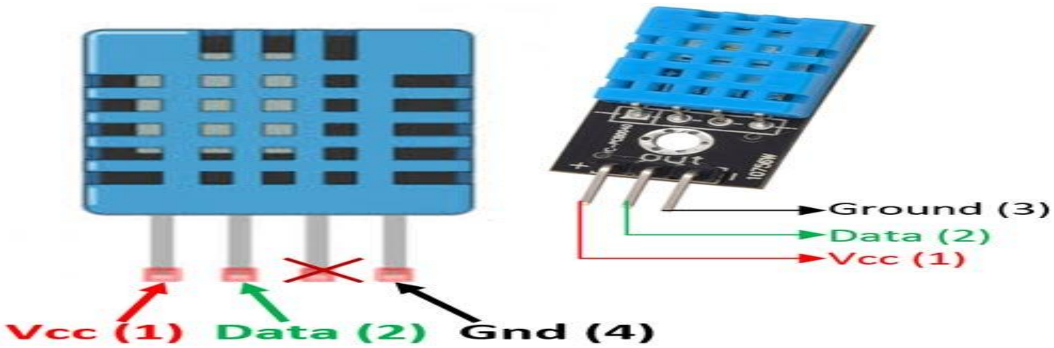


Figure 2: Temperature and Humidity sensor DHT11

3.3.2. Carbon dioxide sensor:

The carbon dioxide sensors also used as a separate module of MG-811 series. It is more sensitivity to CO2 gas particularly. The operating voltage is VCC: 6V DC. The output may be in the form of Analog mode. We can easily convert in to digital form with help of Arduino Uno Board circuit and its software. This sensor is more compatible for Arduino Uno and Raspberry pi. It is used in Green house analysis. The threshold value for carbon dioxide is 350 ppm as per ASHRAE –American standard. The carbon dioxide gases would be come from automobile combustion and Industrial exhaust gases mixed with air as a outdoor source.

3.3.3.Formaldehyde (HCHO) gas sensor:

It is a odor gas available in the form cent and nail polishes in office/home places. It leads to asthma when the threshold value is high in office/class room. The threshold value is 30µg/m^3. We observed that the value of HCHO is within the limit in the class room/USIC/MKU

3.3.4.Wi-Fi MODULE:

The utilized Arduino Uno ESP8266 board was a special kind in this series, which having a inbuilt Wi-Fi module with TC/IP protocol. So that the system was easily connected to Wi-Fi Network in the form of plug-in type arrangement. It can work with a supply voltage of 3.3V. The initial connections were initializing with AT commands to configure the Arduino Uno board. Some times more than one Arduino Uno board was used and communicates between them in form of client-server mode. The disadvantage was found in this board was only having minimum number of analog pins.

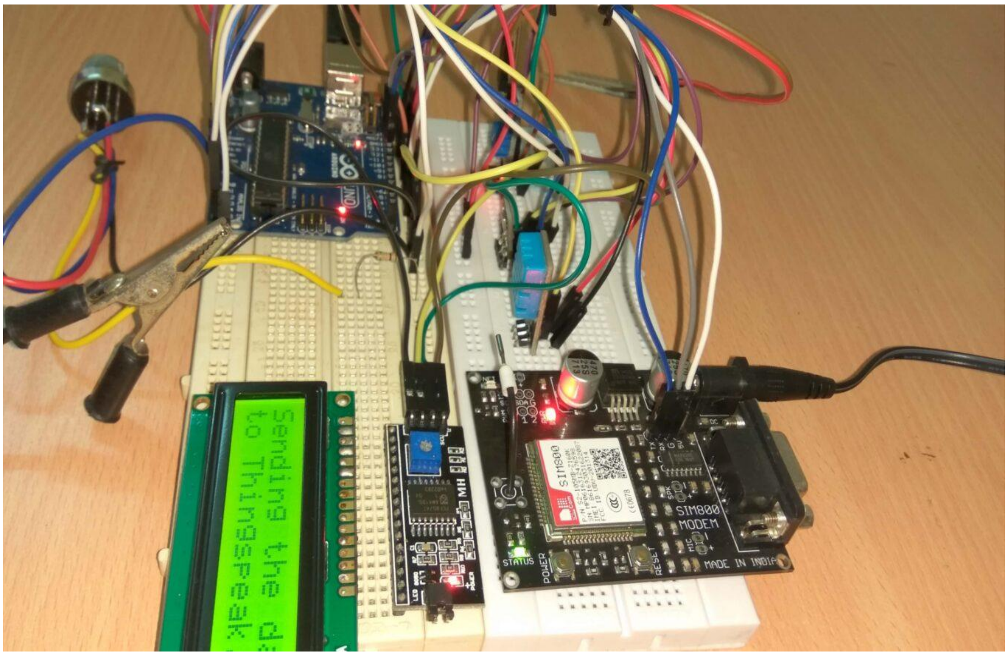


Figure 3 : Ardunio Uno board fitted with various sensor setup

IV.RESULT AND DISCUSSION:

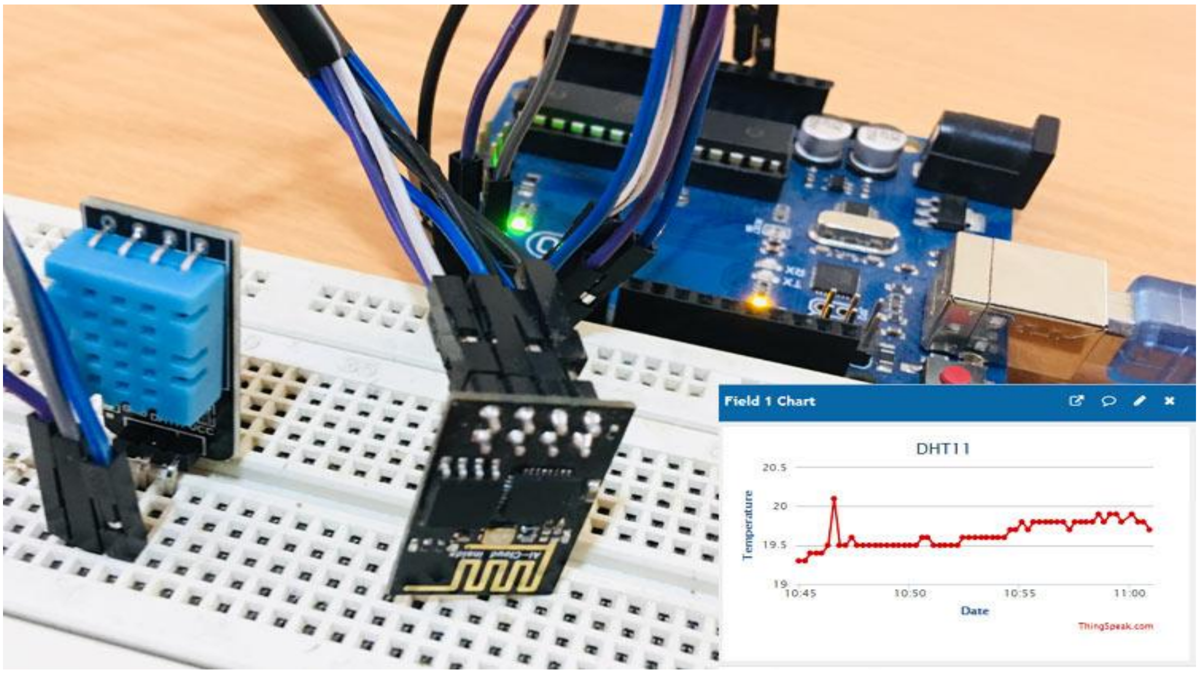


Figure 4: Arduino Uno board with 9V DC power supply

From the above set up we can easily get the data from it. The parameter of temperature standard value is:(20.5-23.7) ℃ in winter season. This temperature value is compared with temperature observed in USIC were (22-35) ℃. The temperature measured was high during this period, which affects the human health. The American relative humidity standard is -RH : (30%-60%). The observed data lies between (65-88)%. The observed humidity limit was high when compared with its American standard value. The date on which the samples were randomly taken a particular day Dec 12, 2020(12-12-2020) and sep 15,2021 at MKU campus, USIC centre. In the USIC Class room, the number of students occupied was 11 and class room area (16x14)m^2. In winter season (12-12-2020),the CO_2 observed was 419 ppm, which was a high value, when compared with the CO_2 standard value of :(350 ppm). The sample data taken would gives information about the USIC class room status. Also, It gives the real data for the research observer. So, we can easily establish smart class room in USIC. The data are displaced in LCD display available in the Arduino Uno board with serial connections. Whenever the LCD used for display purpose, it should be reset before start of the program running. We are using 16X2 LCD display device is used for this project.

4.1. GRAPH DETAILS:

The Bar graph was drawn based on table-5 critical values of various air quality parameters such as AQI, Temperature, Humidity, and CO_2 based on three different time indication in a day in the month of December (winter season): dated 12-12-2020.

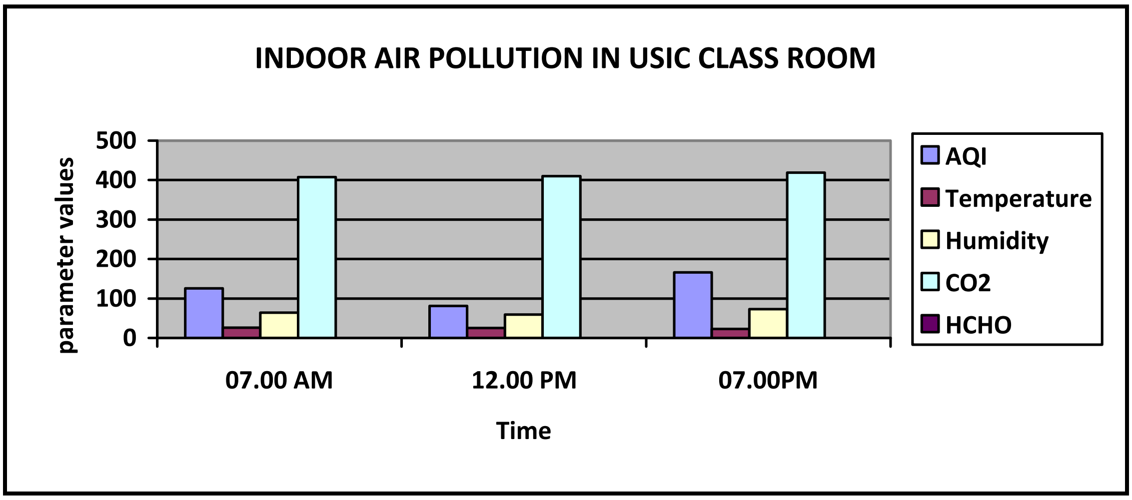


Table 1: Indoor air pollution for column Graph data for a day 12-12-2020:

Parameters	07.00 A.M	12.00 P.M	07.00 P.M
AQI	126	81	166
Temperature (℃)	26	25	23
Humidity (%)	64	59	73
CO_2 PPM	408	410	419
HCHO mg/m^3	0.001	0.012	0.003

Table 2: Indian standard value of indoor air pollution :

variable	Winter data observed(avg)	Winter (std-value)	Monsoon data observed(avg)	Monsoon (std-value)
Co_2 ppm	480	300	1080	1000
Humidity (%)	63.16	30-65	58.36	30-65
Temp (℃)	28	23	33	26
TVOC mg/m^3	0.384	0.5	0.002	0.5
HCHO mg/m^3	0.003	0.1	0.002	0.1
Pm2.5 µg/m^3	75.56	60	12.93	60
PM10 µg/m^3	84.93	100	11.57	100
AQI	119	0-50	20.93	51-100

We used around three types of air monitoring instrument systems to calculate the Indoor air pollution USIC building. They were
1) **SMILEDRIVE** instrument (smart sensor instrument) for (HCHO, TVOC, PM10)
2) **PranaAir** instrument (smart sensor instrument for (AQI, CO2, PM2.5) and
3) **IOT** based air quality monitoring system for (Temperature, humidity).

The date on which the samples were randomly taken a specific/particular day Dec 12, 2020(12-12-2020) in winter season and Sep 15, 2021 was taken in monsoon season at MKU campus, USIC centre for drawing bar graphs. In the USIC Class room, the number of students occupied at that time was 11 students and class room area (16x14)m^2.
1) The observed reading of Carbondioxide temperature was in the range of minimum value (400)PPM to maximum value of (408)PPM and

average data of Carbon dioxide Temperature was (300)PPM in the **winter season** against the standard value of (1000) PPM. In the **monsoon season** the Temperature value was in the minimum value of (845)PPM to maximum value of (1185)PPM against the standard value of (1000)PPM.

1) The observed reading of Temperature was in the range of minimum value (27.2) ℃ to maximum value of (30.4) ℃ and average data of Temperature was (26.1)℃ in the **winter season** against the standard value of (23.0) ℃. In the **monsoon season** the Temperature value was in the minimum value of (26.2)℃ to maximum value of (35.4)℃ against the standard value of (31.30)℃ .

2) The observed reading of TVOC was in the range of minimum value (0.142) mg/m^3 to maximum value of (0.790) mg/m^3 and average data of Temperature was (0.384) mg/m^3 in the **winter season** against the standard value of (0.5) mg/m^3. In the **monsoon season** the TVOC value was in the minimum value of (0.000) mg/m^3 to maximum value of (0.0193) mg/m^3against the standard value of (0.5) mg/m^3. In winter season and monsoon season, the values were under control.

3) The observed reading of HCHO was in the range of minimum value (0.062) mg/m^3 to maximum value of (0.12) mg/m^3 and average data of HCHO was (0.077) mg/m^3 in the **winter season** against the standard value of (0.1)mg/m^3. In the **monsoon season** the HCHO value was in the minimum value of (0.001) mg/m^3 to maximum value of (0.010) mg/m^3 against the standard value of (0.1) mg/m^3.

4) The observed reading of PM2.5 was in the range of minimum value (53) to maximum value of (100) and average data of $PM_{2.5}$ was (75.56) $\mu g/m^3$ in the **winter season** against the standard value of 60 $\mu g/m^3$. In the **monsoon season** the $PM_{2.5}$ value was minimum(6) $\mu g/m^3$ and Maximum of (27) and average value of (12.93) against the standard value of 60 $\mu g/m^3$. During the observation the winter season had higher value of (>60) $\mu g/m^3$ and in monsoon was within the limit of (<60 $\mu g/m^3$).

5) The observed reading of PM10 was in the range of minimum value (61) to maximum value of (116) and average data of PM_{10} was 84.93 $\mu g/m^3$ in the winter season against the standard value of 100 $\mu g/m^3$. In the monsoon season the PM_{10} value was minimum(25) $\mu g/m^3$ and maximum of(62) $\mu g/m^3$ and average value of (41.5) $\mu g/m^3$ against the standard of 100 $\mu g/m^3$. Both winter and summer season the PM10 value were under control level.

6) The observed reading of humidity was in the range of minimum value (53%) to maximum value of (67%) and an average of (58.36%) against the standard value of (65%)in the monsoon season and minimum value (52%) to maximum value of (73%) and an average of (63.18%) against the standard value of (65%) in the winter season. During the observation, the humidity values were found less than the maximum limit (<65%).

7) The observed reading of AQI was in the range of minimum value (10) to maximum value of (45) and an average of (20.93) against the standard value of (<50)in the **monsoon season** and minimum value (81) to maximum value of (166) and an average of (119) against the standard value of (<100) in the **winter season**. During the observation, the AQI values were found within the limit winter of (0-50) range and slightly higher (119) in Monsoon of (51-100) range.

The sample data taken would gives information about the USIC class room status. Also, it gives the real data for the research observer. So, we can easily establish smart class room in USIC. The data are displaced in LCD display available in the Arduino Uno board with serial connections. Whenever the LCD used for display purpose, it should be reset before start of the program running. We are using 16X2 LCD display device is used for this project.

4.2. Statistical approach of air pollution variables and its value verification:

The NULL hypothesis was framed first for indoor air pollution calculation.

Let us Assume: All indoor (parameters) variable mean values are equal or Same for (1 to n- groups)

$$H_o = \mu1=\mu2=\mu3=\mu4=\ldots\ldots\mu_n$$

Result 1: Fixing of all indoor (parameters) variables mean values are equal

Step 2: The condition for Alternate hypothesis is any one of the group mean is different from others (rest of the mean values) (or) all means are not equal

$$H_a = \mu1\neq\mu2\neq\mu3\neq\mu4\ldots\ldots\mu_n$$

Ha ≠ {μ1=110.8 , μ2=236.0075, μ3=78.05,
μ4=59.75, μ5=79.625, μ6=27.1478,
μ7=65.775, μ8=49.125, μ9=94.325,
μ10=42.8275, μ11=51.445, μ12=1254.85 }

Result 2: From the above mean values of different groups were found different i.e) They were not in equal. So, we accept the Alternate Hypothesis

Step 3: The correlation, regression, standard deviation, mean, Max value are obtained From Excel → Data → Data analysis → Descriptive statistics tool Selection

Skewness = { -0.8586, 0.32206, 0.98798, 0.06052,-0.02175, 0.50559, 0.78619, 0.11317, 0.12024, 0.56274, 0.56185,-0.1482, -0.1031}

Kurtosis = { -1.1079, -0.5318, 0.6812,-0.4949, -0.9189, -0.1434, -0.6384, -0.3859, -0.5051, -0.806,-1.4939,-1.4753, -1.1635 }

Result 3a: The skewness values fall on –ve to +ve gives the curve shape of right skew shape

Result 3b: The kurtosis values fall on –ve, so the curve shape may be lepotokurtic shape , that is the data points are in the narrow line about the centre with more height than normal shape

Step 4: The ANOVA single factor-test output result was obtained by selection of tool

Excel → Data → Data analysis → Single factor ANOVA selection

Step 5: The p-value was noted from the ANOVA table result. Similarly the value of F and $F_{critical}$, SS ,df and MS also noted for comparison $F_{critical}$ =1.8091183, F=25.2472328, SS =297619, df = 11, MS= 27056.3 and p-value=5.1E-41

Step 6: Checking of the value of p: if ($p < 0.05$) is true or false p-value=5.1E-41

Result 4: The p-value less than 0.05, so that accept the alternate hypothesis

Step 7: Checking of the value of result: if ($F > F_{critical}$ value) is true or false

$F_{critical}$ =1.8091183 F=25.2472328

F=25.2472328 >$F_{critical}$ =1.8091183

Result 5: The F – value is greater than f-critical value, then accept alternate hypothesis

Step 8: If steps 6,7 are true, then reject the NULL Hypothesis and accept Alternate hypothesis.

Result 6: From the above value step 6,7 are not true

Step 9: If steps 6,7 are false then accept the NULL hypothesis was rejected otherwise the Alternate Hypothesis was accepted (Failed to reject NULL hypothesis)

Result 7: From the above values the step 6,7 are true and accept the alternate hypothesis

Step 10: significance level test: Check the value : if ($p<0.05$) is true or not

p-value=5.1E-41

Result 8: The above -value is less than 0.05. It indicates that , the variable significance between them are strong.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	40	4432	110.8	3992.574359
Column 2	40	920.3	23.0075	6.331480769
Column 3	40	3122	78.05	54.66410256
Column 4	40	2390	59.75	830.8076923
Column 5	40	3185	79.625	1932.855769
Column 6	40	1085.91	27.14775	16.93335635
Column 7	40	2631	65.775	77.66602564
Column 8	40	1965	49.125	373.4967949
Column 9	40	3773	94.325	4099.917308
Column 10	40	1713.1	42.8275	374.4774295
Column 11	40	2057.8	51.445	452.1261282
Column 12	40	2194	54.85	647.9769231

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	297618.8	11	27056.25	25.24723285	5.06E-41	1.809118298
Within Groups	501533.3	468	1071.652			

Total	799152.1	479

Column1		*Column2*		*Column3*		*Column4*
Mean	110.8	Mean	23.0075	Mean	78.05	Mean
Standard Error	9.990714	Standard Error	0.397853	Standard Error	1.169018	Standard Error
Median	120	Median	22.05	Median	76.5	Median
Mode	96	Mode	21.2	Mode	73	Mode
Standard Deviation	63.18682	Standard Deviation	2.516243	Standard Deviation	7.393518	Standard Deviation
Sample Variance	3992.574	Sample Variance	6.331481	Sample Variance	54.6641	Sample Variance
Kurtosis	-0.53179	Kurtosis	0.6812	Kurtosis	-0.49492	Kurtosis
Skewness	0.322054	Skewness	0.987977	Skewness	0.060518	Skewness
Range	234	Range	11.2	Range	29	Range
Minimum	16	Minimum	19.6	Minimum	63	Minimum
Maximum	250	Maximum	30.8	Maximum	92	Maximum
Sum	4432	Sum	920.3	Sum	3122	Sum
Count	40	Count	40	Count	40	Count

	Column5		*Column6*		*Column7*		*Column8*
59.75	Mean	79.625	Mean	27.14775	Mean	65.775	Mean
4.557433	Standard Error	6.951359	Standard Error	0.650641	Standard Error	1.393431	Standard Error
68	Median	80	Median	25.6	Median	65	Median
63	Mode	36	Mode	25.4	Mode	64	Mode
28.82373	Standard Deviation	43.96426	Standard Deviation	4.115016	Standard Deviation	8.812833	Standard Deviation
830.8077	Sample Variance	1932.856	Sample Variance	16.93336	Sample Variance	77.66603	Sample Variance
-0.91886	Kurtosis	-0.14341	Kurtosis	-0.63837	Kurtosis	-0.38594	Kurtosis
-0.21745	Skewness	0.505593	Skewness	0.786192	Skewness	0.113175	Skewness
107	Range	172	Range	14.5	Range	38	Range
9	Minimum	10	Minimum	21.1	Minimum	47	Minimum
116	Maximum	182	Maximum	35.6	Maximum	85	Maximum
2390	Sum	3185	Sum	1085.91	Sum	2631	Sum
40	Count	40	Count	40	Count	40	Count

	Column9		*Column10*		*Column11*		*Column12*	
49.125	Mean	94.325	Mean	42.8275	Mean	51.445	Mean	54.85
3.055719	Standard Error	10.12413	Standard Error	3.059728	Standard Error	3.362016	Standard Error	4.024851
51	Median	81.5	Median	32.35	Median	60.5	Median	58

57	Mode	65	Mode	72	Mode	61	Mode	62
19.32607	Standard Deviation	64.0306	Standard Deviation	19.35142	Standard Deviation	21.26326	Standard Deviation	25.45539
373.4968	Sample Variance	4099.917	Sample Variance	374.4774	Sample Variance	452.1261	Sample Variance	647.9769
-0.50511	Kurtosis	-0.80598	Kurtosis	-1.4939	Kurtosis	-1.4753	Kurtosis	-1.16347
0.12024	Skewness	0.562736	Skewness	0.561847	Skewness	-0.14819	Skewness	-0.10312
77	Range	220	Range	53.7	Range	65.2	Range	90
10	Minimum	10	Minimum	22.3	Minimum	21.8	Minimum	9
87	Maximum	230	Maximum	76	Maximum	87	Maximum	99
1965	Sum	3773	Sum	1713.1	Sum	2057.8	Sum	2194
40	Count	40	Count	40	Count	40	Count	40

V.CONCLUSION:

In this study, we come to a conclusion that the indoor air pollution concentration was monitored and analyzed inside USIC rooms in Madurai kamaraj university campus. The available pilot data shown that all the pollution concentration monitored in USIC building were high against the Indian air pollution standard. This leads to health related problems for students and staffs. The ANOVA test also given a complete information about the strong significance between parameters and degree of relationship between parameter groups. From the ANOVA summery report we come to a conclusion that there is a strong significance relationship was founded between Temperature with humidity and temperature with particulate matter and other parameters such as (HCHO,CO_2).

This arrangement given an idea about establishment of smart class room /office / Lab in this University campus to ensure a pollution free environment with low cost smart air pollution monitor installation permanently in a specific place.

The further study on this matter would leads to maintain a zero indoor air pollution in all working place in MKU-campus buildings by advanced detection method like IOT based remote sensor technology with remote data transfer method with Wi-Fi module and alert with a mobile phone message to working people in a building.

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