MINI PROJECT
(2020-2021)

IOT Based Pollution Monitoring System

FINAL REPORT

Institute of Engineering & Technology

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CERTIFICATE

Candidate's Declaration

This is to certify that the work which is being presented in the report entitled **"Air Pollution Monitoring through Internet Of things"** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and application** submitted in the department of Computer Science & Engineering and application**, GLA University MATHURA** is an authentic record of our own work carried out over a period from August 2020 to December 2020 under the supervision of Mr. Amir Khan (technical trainer, Computer Science & Engineering and application Department).

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ABSTRACT

Air Contamination is a major issue these days. It is essential to screen Air Quality and monitor it for future and sound living for all. So, we propose an Air Quality observing system that help us to find and check live air quality through IOT.

It utilizes air sensor to detect nearness of destructive gases found all around and transmits this information to microcontroller. The sensor associated with forms this information and sends it over to the web. This enables us to screen air contamination in various zones and make a move to combat it. In addition, there is a temperature sensor for estimating the temperature of a room.

<u>INTRODUCTION</u>

In this project we will make an IOT Based Air Pollution Monitoring System in which we will screen the Air Quality over a web server utilizing web and it will trigger an alert when the air quality goes down past a specific level, implies when there are adequate measure of hurtful gases are available noticeable all around like CO_2, smoke, liquor and furthermore temperature.

It will demonstrate the air quality in PPM as on website page with the goal that we can screen it effectively.

The proposed project is an implementation of an application of the Internet of Things.

The undertaking is that is to give an implementation of IOT to estimate the room temperature as well as the air quality. The undertaking highlights the management of sensors to retrieve the data. The major advantage of using sensor is that the user will have a seamless experience; the user is not required to sanction to feed any marker for Internet of Things to work. Hence the efficiency is greater and here after the anticipation taken to execute, user interrogation is pity than distinctive mechanisms. The working of the application is also further more described in this documentation. The documentation furthermore lists out the requirements for the project implementation

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1.1) PROBLEM STATEMENT

An effective natural observing framework is essential to screen and estimate the conditions in the event of surpassing endorsed level of parameter (for example, commotion, CO and radiation levels). At the point when the items like condition furnished with sensor gadgets, smaller scale controller and different programming applications turn into a self – securing and self-observing condition.

Amid past decades, as consequence of human advancement and urbanization there is a tremendous development in polluting businesses, open consuming of reject and leaves, monstrous amounts of development squander, generous loss of timberlands and vehicles (especially diesel driven autos) on streets that offer ascent to wellbeing imperiling contamination. Along these lines, it is important to consistently screen and report the unsafe effects from air contamination. To screen the nature of air, another system is recommended that screens the parameters of the earth around us, for example, CO_2, CO, nearness of smoke, liquor, LPG, temperature and dampness with the assistance of GSM, Bluetooth and WSN.

1.2) OBJECTIVE

Short-term – The short-term objective of the project is complete understanding of the project assigned. The concepts related to the project should be clear and the objective behind the project should be known to the entire team. The focus should not be only on theoretical concepts but also on practical implications of them. The technology used to implement the projects should be familiar and also one should be able to apply them on our respective project.

Long-term – Long-term objective includes that students are exposed to the industrial environment which should help us in future when we will work in real-time projects. One should gain experience of working with a team and learn to cooperate with our team members.

1.3) METHODOLOGY

To alleviate the effects of air and clamor contamination on human wellbeing, worldwide condition and overall economy, governments have set up enormous endeavors. With nitty gritty data of the air and clamor contamination circumstance, researchers, arrangement creators and organizers can settle on educated choices on overseeing and enhancing the living condition. An answer for checking the clamor and air quality levels utilizing inserted registering is proposed. The inserted framework used to screen the vacillation of parameter like clamor and air contamination level from typical levels.

```
        Internet
       /        \
      /          \
     /            \
   PC          Sensor
              Device
```
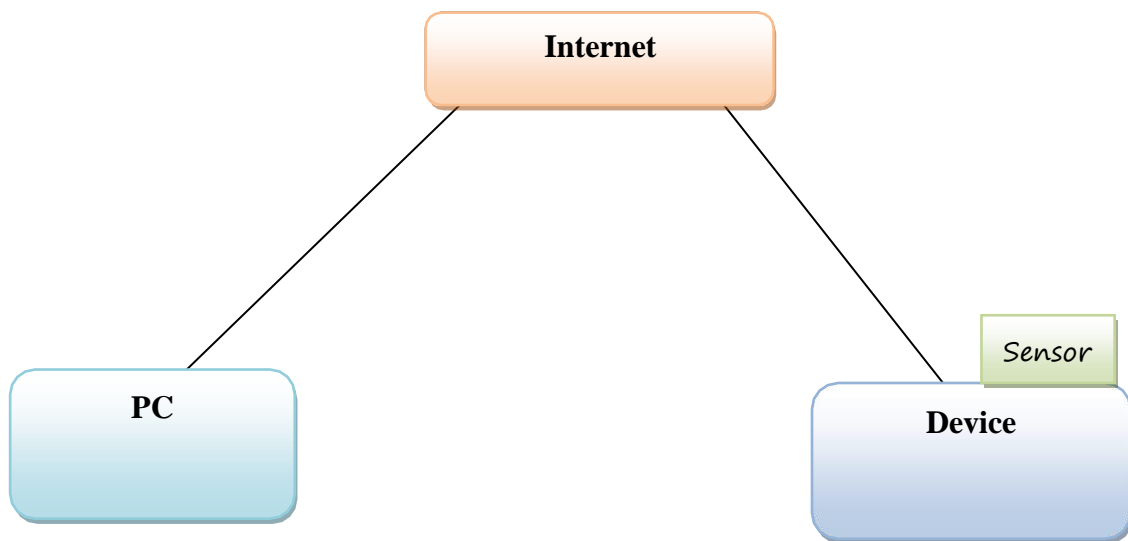
2.1) Title: "Air Quality Monitoring System based on Arduino Microcontroller"

Remembering the ultimate objective to screen nature of air, a Wireless sensor organize (WSN) based new framework is proposed which relies upon data securing and transmission. The parameters of the earth to be watched are picked as temperature, sogginess, volume of CO, volume of CO2, area of spillage of any gas - smoke, alcohol, LPG. The estimations of these parameters are transmitted by using Zigbee Pro (S-2) to a base station where they are being watched. The estimation of temperature and dampness are transmitted over Bluetooth in like manner so every person in the extent of the system can check it over their propelled cell phones and PCs as these parameters hold hugeness to everyone. CO, a dangerous parameter is checked with an extra protect. A text is sent to the base station through GSM module at whatever point its volume outperforms a particular safe limit got ready for a particular application.

2.2.1) Wireless Sensor Network

Remote sensor compose is an arrangement of sweeping number of flexible and static sensor center points with correspondence system which helps in recording and watching parameters like temperature, weight, stickiness, speed and twist course, stable power, light power, vibration drive, control line voltage, basic body limits substance obsessions and toxin levels using multi-ricochet and self-affiliation technique.

WSN comprises of sensor hubs from handfuls to thousands contingent on their use and each hub has basic element to register, spare and communicate information. In the time of awesome mechanical improvement, the word remote is getting to be well known in each field and therefore WSN will be next mechanical market for profiting. The advances utilized as a part of WSN are time synchronization, arrange convention, limitation, security organization, information total and power administration. Impediments in specific parameters, for example, handling power, transmission capacity, vitality also, capacity makes the assignment of giving security to the system extremely troublesome.

The steering of WSN is actualized in unexpected path in comparison to traditional directing of a settled system; in this manner investigation of steering conventions is a key point to outline any remote systems which are appeared in Fig.3
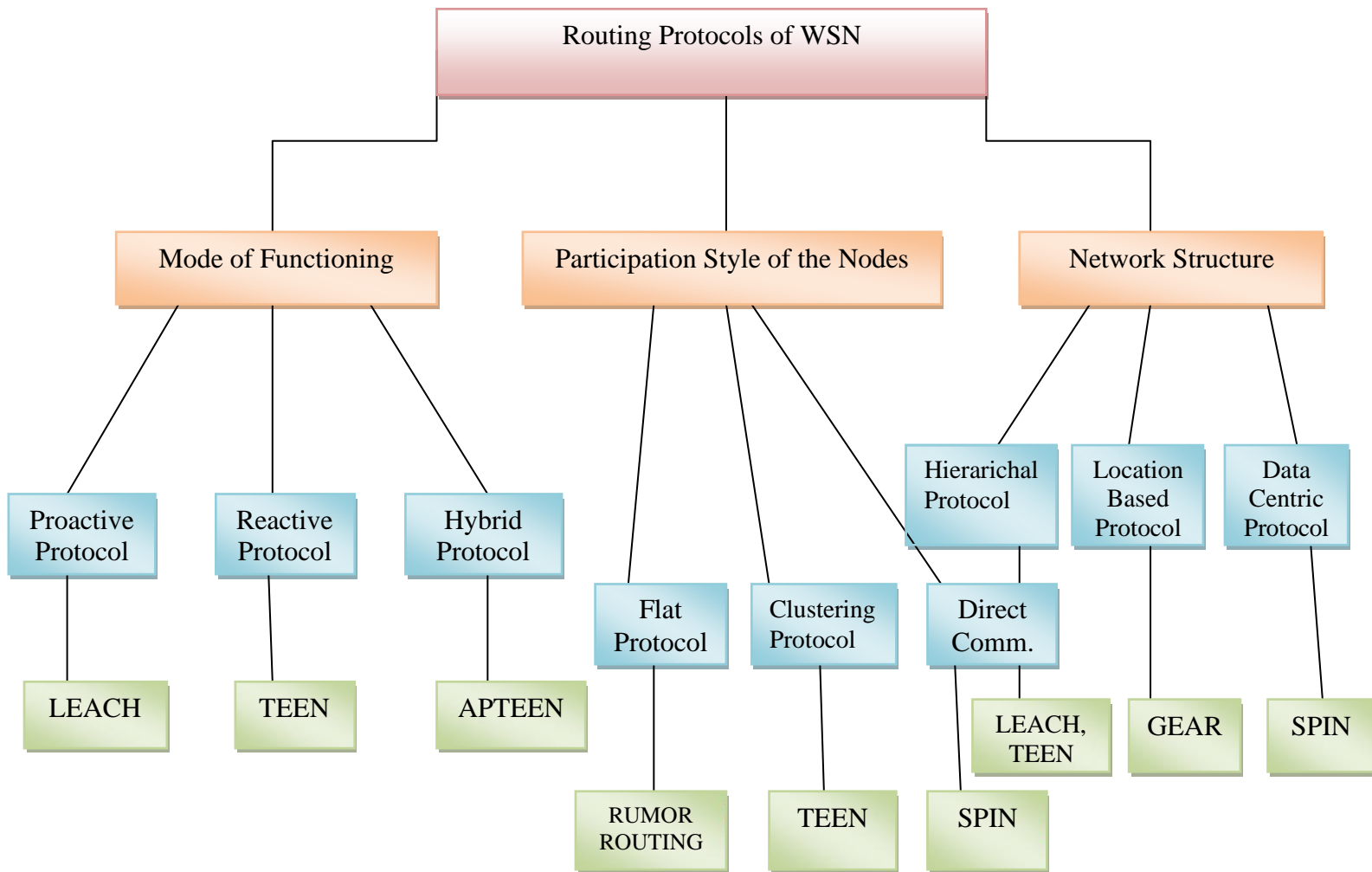
Figure 3: Routing Protocols of WSN

2.2.2) Related Work

GIS based system is formed, executed and endeavored to screen the air contamination of any region. It contains a microcontroller, gas sensors, flexible unit, a transient support and a server with web arrange which accumulates data from different regions close by compose information at certain period of a day. The data for particular territory are touched base at the midpoint of in a close time and space. The GPS module is added to a structure to give correct depiction of defilement sources in a district. The recorded data is discontinuously traded to a PC through a GPRS affiliation and after that the data will be appeared on the submitted site with customer affirmation. In this manner generous number of people can be benefitted with the broad information gathering framework.

GSM/GPRS based framework for recording ecological information, for example, temperature and mugginess utilizing Arduino Uno Microcontroller is proposed in which esteems are put away utilizing SD card joined to GPRS module instead of Arduino Uno memory. The GPRS module is utilized to give different capacities like the transmission of the information, continuous clock usefulness, and information stockpiling on a Micro SD card.

Contamination can be adequately observed with the utilization of WSN is equipped for giving a continuous contamination information. The adjustment of gas sensors like CO_2 gas sensors, NO_2 gas sensor is finished by utilizing different reasonable alignment innovations and after that WSN is shaped utilizing a multi jump information conglomeration calculation. The contamination information is appeared in the type of number and outlines with the assistance of web interface and is accessible on web too. Temperature and mugginess parameters are estimated alongside the gases and information is dissected information combination.

The framework is sent in people in general transport like transports which have dependable and settled courses. The model incorporates Portable Sensing Box (MSB) which comprises of a microcontroller, sensors, GPS framework and a cell modem. The power supply is given by associating with the transport battery to work this model. The grouping of CO and particulate issue is estimated in the proposed framework. The framework comprises of different observing stations, which are ready to discuss remotely with the utilization of backend server, outfitted with the metro legitimate sensor and gas sensor for recording information remotely. The constant information which is gathered through a backend server is changed over to the valuable data for the client with the assistance of online interfaces.

2.2.3) Air Quality Parameters

The imperative parameters that are considered in the proposed structure include:

Carbon Monoxide Gas: Carbon Monoxide (generally called CO) is a bleak, unscented unsafe gas and is a normal yet behind death from hurting far and wide. Around half of the going from startling CO harming result from the internal breath of smoke from blazes. Other basic causes are vehicle exhausts and going in present day/business settings.

Carbon Dioxide Gas: Carbon dioxide is accessible in the Earth's condition at a low concentration and goes about as an ozone hurting substance. In its solid state, it is called dry ice. It is a significant piece of the carbon cycle.
Climatic carbon dioxide gets from various consistent sources including volcanic out gassing, the start of regular issue, and the breath methods of living fiery living creatures; man-impacted wellsprings of carbon dioxide to desire the most part from the expending of various oil based commodities for control age and transport use.
Additionally, plants in like manner release oxygen to the earth, which is thusly used for breath by heterotrophic living creatures, encircling a cycle.

Smoke: Smoke is a social event of solid and liquid particles and gases emanated when a material encounters start together with the measure of air that is mixed into the mass. It is routinely an unwanted symptom of blazes (chimneys, oil lights, and stacks), Smoke is used as a piece of functions where incense, sage, or pitch is seared to make an aroma for significant purposes. Smoke is on occasion used as a flavoring administrator, and added substance for various foodstuffs. Smoke is in like manner a section of internal consuming engine exhaust gas, particularly diesel vapor.

LPG: Liquefied oil gas in like manner are ignitable mixes of hydrocarbon gases used as fuel in warming machines, cooking apparatus, and vehicles. It is dynamically used as a fuel and refrigerant supplanting cfc's with a true objective to decrease mischief to the ozone layer. Right when especially used as a vehicle fuel it is much of the time implied as auto gas. In the northern side of the equator winter, the mixes contain more propane, while in summer, they contain more butane. In the United States, transcendently two assessments of LPG are sold: business propane and HD-5. These judgments are conveyed by the GPA and ASTM.

LAYOUT DIGRAM
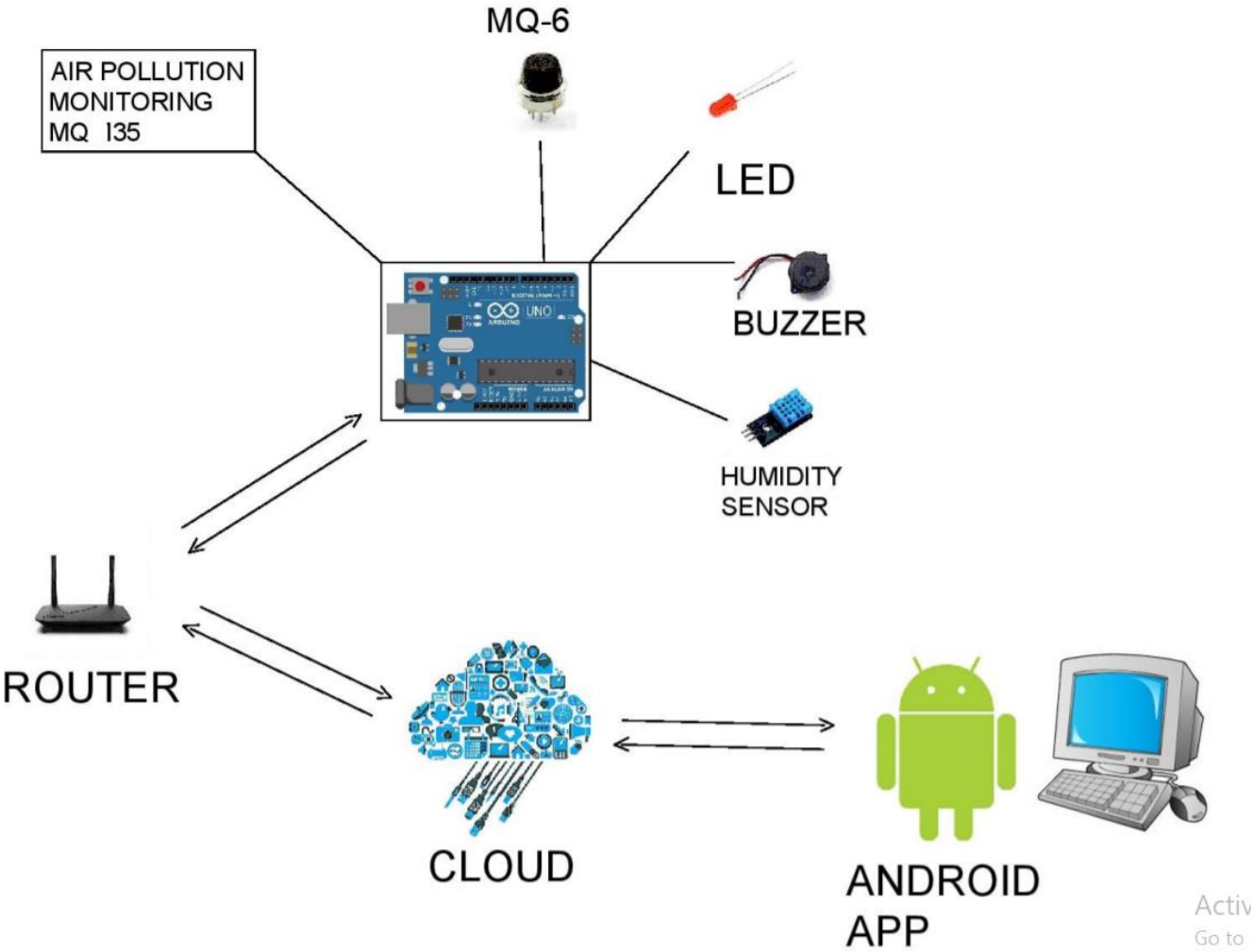
2.2.4) Conclusion

The framework to screen different parameters of condition utilizing Arduino microcontroller, WSN and GSM Technology is proposed to enhance nature of air. With the utilization of advancements like WSN and GSM improves the procedure of observing different parts of condition, for example, air quality checking issue proposed in this paper. The discovery furthermore, checking of perilous gases is considered in a genuine way and related safeguards have been considered here as an alarm message and a bell so the fundamental move might be made. It is assessed that this framework will have an incredible acknowledgment in the market as it is a unified framework for an entire observing work.
This checking framework can be improved by including remote system card for capacity of qualities from sensors appended to microcontroller and additionally more gas sensors could be utilized like Nitrogen dioxide (NO2), Ammonia (NH3), Sulfureted Hydrogen (H2S), liquor and so on. Another part of estimating particulate issue can be acquainted with make it more progressed.

1. <u>SYSTEM DEVELOPMENT</u>

3.1)   SOFTWARE REQUIREMENTS:

- Proteus for designing circuit.
- Arduino IDE
- Web Browser

3.2)   HARDWARE REQUIREMENTS:

- Arduino
- Transformer
- MQ135
- MQ 5
- Buzzer
- Voltage Regulator
- DHT11
- Wires

3.3) SYSTEM REQUIREMENTS:

- CPU: 2.2 GHz Processor and above
- RAM: 4 GB or above
- OS: Windows 7 or above

3.4) Hardware Specifications:

Arduino Uno:

Product Description:

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world.
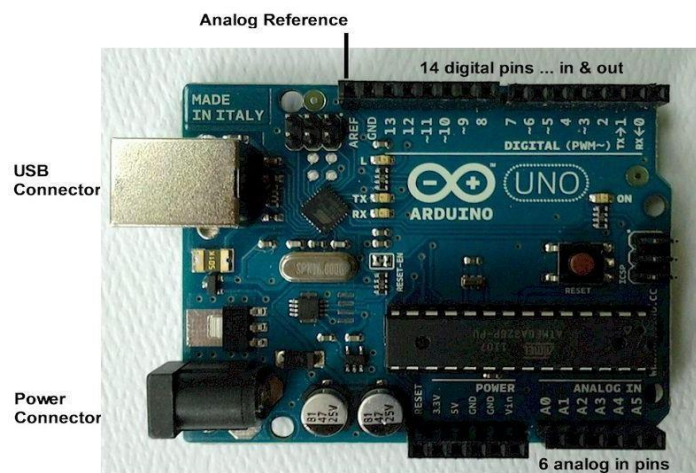
Arduino Uno

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the

Processing language project.

Pin Description:

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

Pin Description of Arduino Uno

Technical Specification:

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Technical Specification of Arduino Uno

Arduino IDE:

A Code for Arduino may be formed in any programming vernacular for a compiler that produces twofold code for the goal processor. Atmel gives a change space to their microcontrollers, AVR Studio and the more up and coming Atmel Studio.

The Arduino wander gives the Arduino fused headway condition (IDE), which is a cross-organize application written in the programming tongue Java. It began from the IDE for the tongues Processing and Wiring. It joins a code editor with features, for instance, content reordering, looking for and supplanting content, customized indenting, bolster organizing, and semantic structure highlighting, and gives fundamental a solitary tick parts to assemble and exchange tasks to an Arduino board. It moreover contains a message locale, a substance bolster, a toolbar with gets for fundamental limits and a hierarchy of leadership of action menus.

Figure 13: **Arduino IDE**

A program created with the IDE for Arduino is known as a draw. Representations are spared cash on the change PC as substance records with the archive expansion .ino. Arduino Software (IDE) pre-1.0 saved diagrams with the extension .pde.

The Arduino IDE supports the lingos C and C++ using uncommon standards of code arranging. The Arduino IDE supplies an item library from the Wiring wander, which gives various essential information and yield methods.

Customer created code just requires two basic limits, for starting the framework and the standard program circle, that are collected and associated with a program stub crucial() into an executable cyclic authority program with the GNU toolchain, in like manner included with the IDE transport.

The Arduino IDE uses the program avrdude to change over the executable code into a substance record in hexadecimal encoding that is stacked into the Arduino board by a loader program in the board's firmware.

Air Quality Sensor (MQ135):-

Product Description:

Air quality click is suitable for detecting ammonia (NH3), nitrogen oxides (NOx) benzene, smoke, CO2 and other harmful or poisonous gases that impact air quality. The MQ-135 sensor unit has a sensor layer made of tin dioxide (SnO2), an inorganic compound which has lower conductivity in clean air than when polluting gases are present. To calibrate Air quality, use the on-board potentiometer to adjust the load resistance on the sensor circuit.

Fig. 3: MQ135 Sensor

Pin Description:

- 1, the VDD power supply 5V DC
- 2,GND , used to connect the module to system ground
- 3, DIGITAL OUT, You can also use this sensor to get digital output from this pin, by setting a threshold value using the potentiometer
- 4, ANALOG OUT, This pin outputs 0-5V analog voltage based on the intensity of the gas.

Gas Sensor:

It is a device that distinguishes the closeness of gases in a domain, routinely as an element of a prosperity system. This kind of rigging is used to recognize a gas spill or distinctive radiations and would interface have the capacity to with a control system so a technique can be thusly shut down. A gas pointer can sound an alarm to heads in the area where the gap is going on, allowing them to get out. This sort of device is crucial in light of the way that there are various gases that can be risky to normal life, for instance, individuals or animals.

Figure 14: **MQ5 Gas Sensor**

Types

Gas locators can be assembled by the movement instrument (semiconductors, oxidation, reactant, photograph ionization, infrared, et cetera.). Gas markers come packaged into two guideline outline factors: advantageous devices and settled gas locators.

Helpful discoverers are used to screen the atmosphere around work compel and are either hand-held or worn on dress or on a belt/furnish. These gas identifiers are for the most part battery worked. They transmit sees by methods for fit for being heard and unmistakable signs, for instance, cautions and blasting lights, when unsafe levels of gas vapors are recognized.

Settled compose gas markers may be used for area of no less than one gas makes. Generally, present day sensors are presented on settled kind smooth steel structures and a connection relates the discoverers to a SCADA framework for perpetual checking. A faltering interlock can be authorized for an emergency condition.

The MQ sensor can recognize NH_3, NO_x, alcohol, Benzene, smoke, CO2 and some unique gases, so it is faultless gas sensor for our Air Quality Monitoring Project. When we will relate it to Arduino then it will distinguish the gases, and we will get the Pollution level in PPM (parts per million). MQ gas sensor gives the yield in sort of voltage levels and we need to change over it into PPM. So to change over the yield in PPM, here we have used a library for MQ sensor.

Sensor gave us approximation of 90 when there was no gas near it and the protected level of air quality is 350 PPM and it should not be more than 1000 PPM. When it exceeds the breaking point of 1000 PPM, at that point it starts to cause Headaches, tiredness and dormant , if surpasses above 2000 PPM then it causes expanded heart rate and numerous different illnesses.

At the point where the esteem will be below 1000 PPM, at that point the LCD and website page will show "Natural Air". At this point the esteem will build 1000 PPM, at that point the ringer will begin beeping and the LCD and site page will show "Poor Air, Open Windows". In the event that it will increment 2000 then the bell will continue to beep and the LCD and webpage will show "Threat!
Move to outside Air".

Temperature and humidity sensor (DHT11):-

Product Description:

DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and an NTC temperature measurement devices, and connected with a high-performance 8-bit microcontroller.
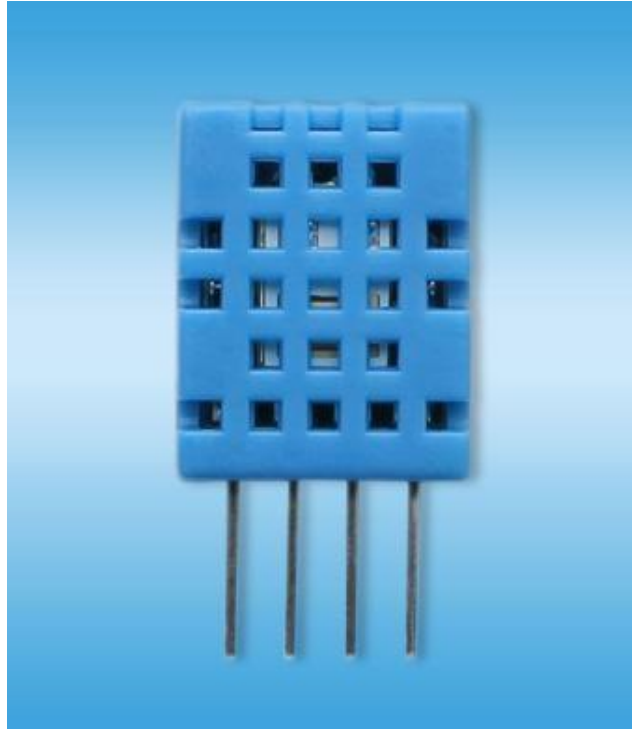
Fig 2: DHT11 Sensor

Pin Description:

- 1, the VDD power supply 3.5～5.5V DC
- 2 DATA serial data, a single bus
- 3, NC, empty pin
- 4, GND, used to connect the module to system ground

BUZZER

Applications of Buzzer
*Alarming Circuits, where the user has to be alarmed about something
*Communication equipments
*Automobile electronics
*Portable equipments, due to its compact size

Buzzer Pin Configuration

Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

3.5) List of Components:

S.NO	Name	Quantity
1	MQ135	1
2	Ribbon wires	
3	Arduino	1
4	MQ-5	1
5	Buzzer	1
6	DHT11	1

3.6) Block Diagram of the Project:

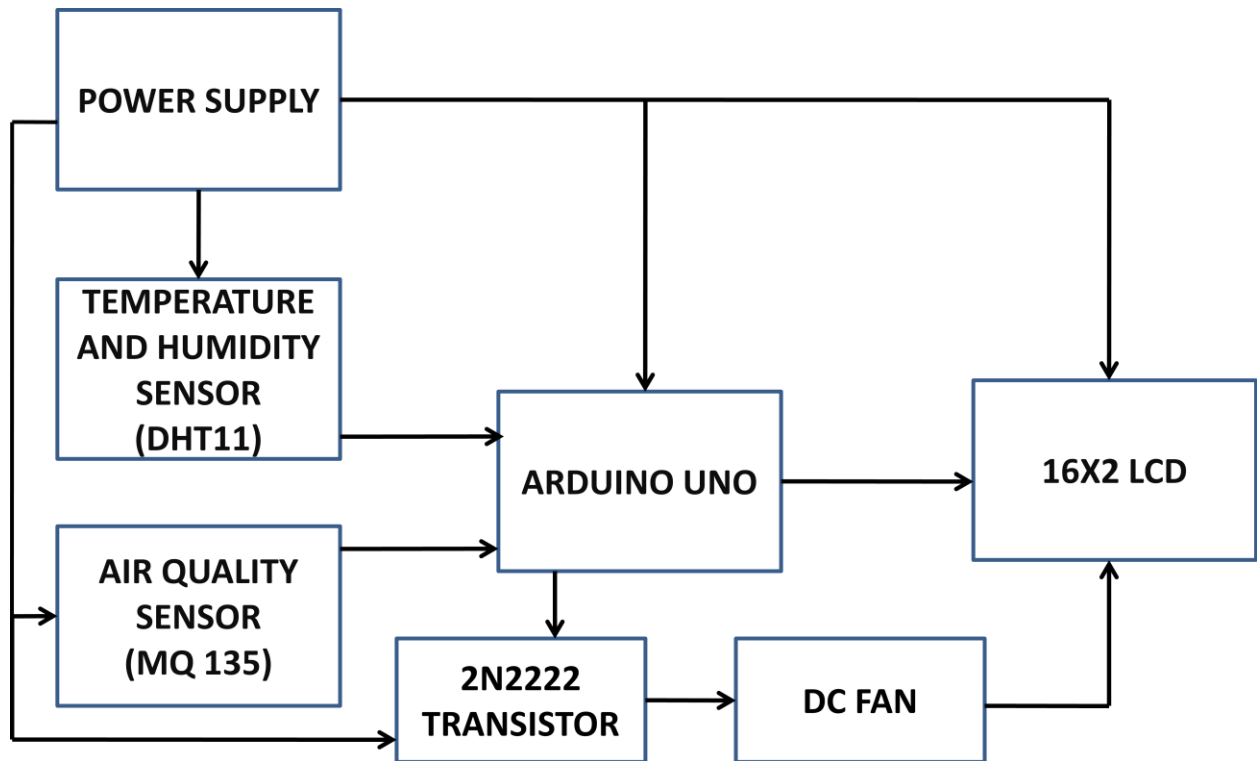**Figure 15**: **Block Diagram**

3.7) Circuit Diagram:

Figure 16: **Circuit**

3.8) Coding:

```
#include <SimpleDHT.h>


int pinDHT11 = A2;
SimpleDHT11 dht11(pinDHT11);
int sensorValue;
int digitalValue;
int sensor=A1;
int gas_value;
const int buzzer = 9;


void setup()
{

Serial.begin(9600); // sets the serial port to 9600
pinMode(13, OUTPUT);
pinMode( 3, INPUT);
pinMode(buzzer, OUTPUT); // Set buzzer - pin 9 as an output
digitalWrite(buzzer, LOW); // Turn buzzer off
pinMode(sensor,INPUT);

}


void loop()

{

sensorValue = analogRead(0); // read analog input pin 0

digitalValue = digitalRead(2);
```

```
if(sensorValue>400)
{

        digitalWrite(13, HIGH);
        digitalWrite(buzzer, HIGH);


}
else
{
        digitalWrite(13, LOW);
        digitalWrite(buzzer, LOW);
        Serial.println(sensorValue, DEC); // prints the value read
        Serial.println(digitalValue, DEC);
}

  Serial.println("Temperature and Humidity");
  byte temperature = 0;
  byte humidity = 0;
  int err = SimpleDHTErrSuccess;

  if ((err = dht11.read(&temperature, &humidity, NULL)) != SimpleDHTErrSuccess) {
        Serial.print("Read DHT11 failed, err="); Serial.println(err);delay(1000);
        return;
  }

  Serial.print("Temperture"); Serial.print((int)temperature); Serial.print(" *C, ");
  Serial.print("Humidity");Serial.print((int)humidity);

  gas_value=analogRead(sensor);
  Serial.println(gas_value);

delay(1000); // wait 100ms for next reading


}
```

3.9) SYSTEM DESIGN:

Flow of events:

Air Quality Sensor: Estimates the Quality of Air in PPM.
Gas Sensor: Estimates the concentration level of gas in PPM.
Temperature and Humidity Sensor: For Temperature and Humidity.
Buzzer : For alert High Pollution.
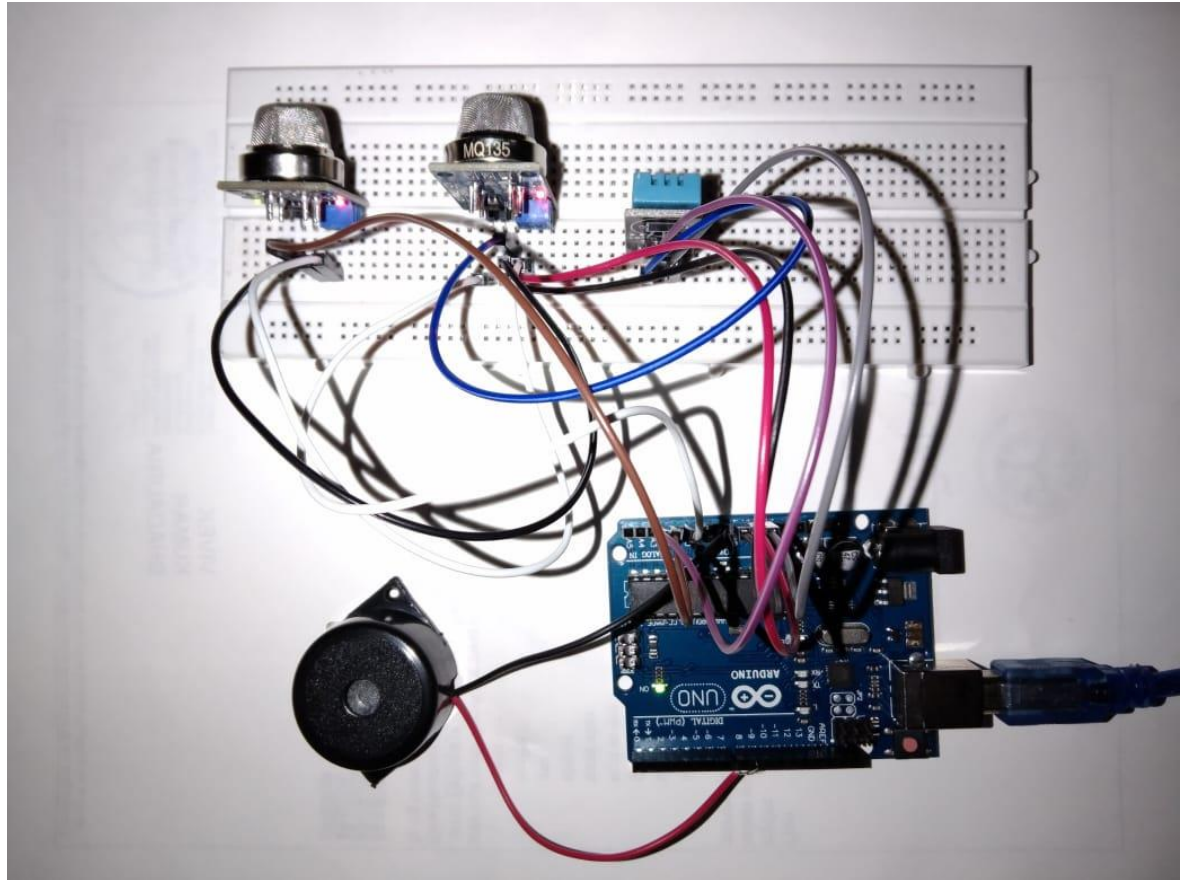
4.1) <u>**RESULT**</u>
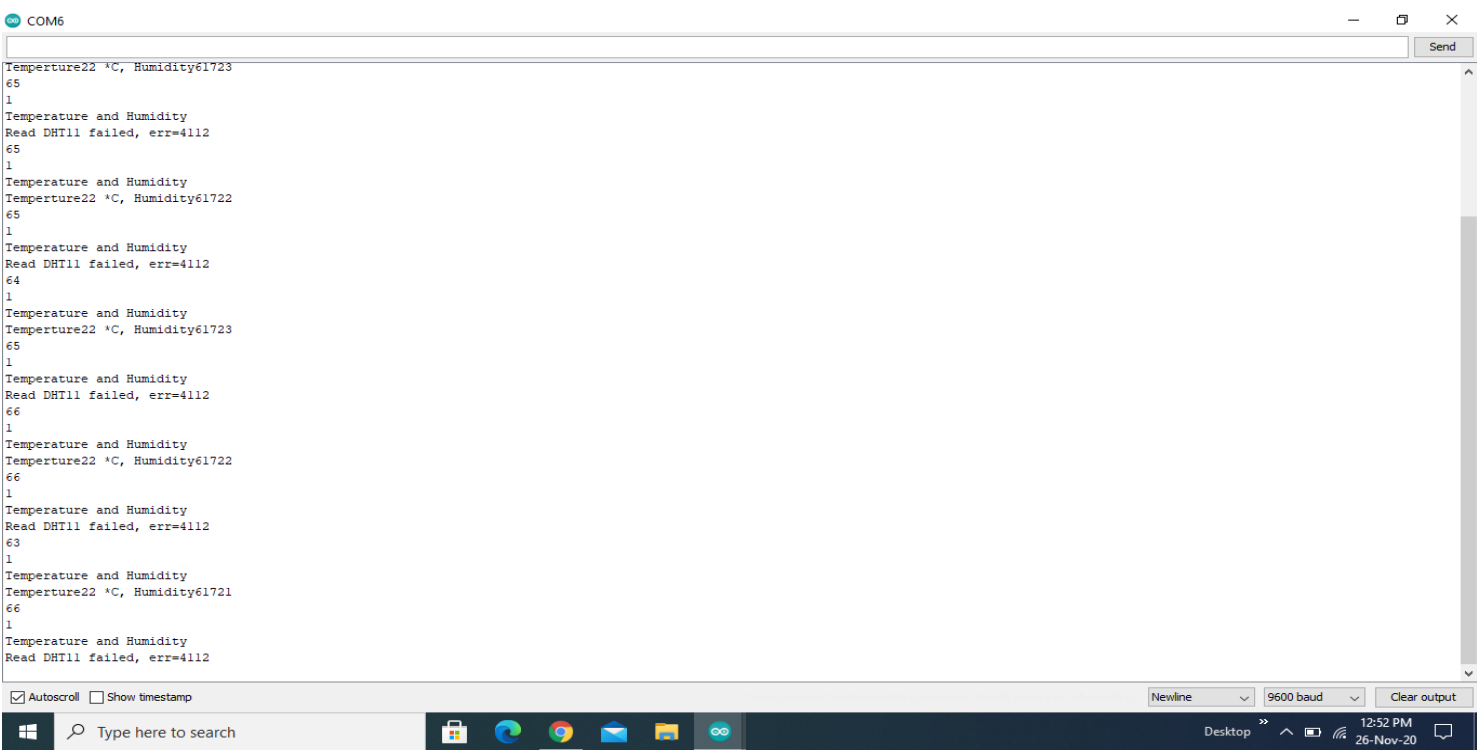

Figure 22: Project Hardware

Figure 23: End Result

5.) CONCLUSION

The framework to screen the demeanor of condition utilizing Arduino IDE, IOT Technology is proposed to enhance nature of air. Utilization of IOT innovation upgrades the way toward observing different parts of condition, for example, air quality checking issue. Utilizing of MQ135 gas sensor gives the feeling of various kind of perilous gas and Node MCU is the core of this undertaking which control the whole procedure.

It is particularly important to mindful the general population with Air Pollution data. It is effectively conceivable by IOT applications. The present hardware and software engineering innovation makes conceivable to build up a few IOT applications. By utilizing these Air Pollution Monitoring IOT applications individuals can lead glad life. These applications give the air contamination data as well as make the general population to consider the air contamination lessening.

The different information and specialized particular of segments required for the framework are talked about with the guide of pseudo-code and framework outline work process. The proposed framework encourages the worry contamination board specialists to take important choice and impart the deliberate PPM esteems to different government and non-legislative associations in a quick and effective way for the advantages of open to have a contamination free life.

5.1) <u>FUTURE SCOPE:</u>

- This could be further improved by designing for global server and designing apps for the real time monitoring.
- To make more advancements by testing the gas sensor with harmful gases and to portray the constituents of the gases.
- To make attempts to measure Noise Pollution and to detect the safe level of sound in decibels.

REFERENCES

[1] " ZigBee for Building Control Wireless Sensor Networks" Fabio L. Zucatto, Clecio A. Biscassi IEEE 2007

[2] Robokits *World **RF Modules** (Tx + Rx Pair) 433 MHz ASK [RKI-1064] - The   RX   ASK is an ASK Hybrid receiver **module,** Online, 15 August 2008*

 < **http://www.robokitsindia.com** >

Books

1.   Author: Muhammad Ali Mazidi & Janice Gillispie Mazidi

The 8051 Microcontroller and Embedded system

Publisher: PEARSON, Prentice Hall, 1990

2.   *RS components* , Catalog book, 2008