

DAYANANDA SAGAR COLLEGE OF ENGINEERING

Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru-5600111
(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' Grade, UGC & ISO 9001:2008 Certified)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“Jnana Sangama”, Belagavi-18, Karnataka, India.



A Mini-Project Report

on

“Air Quality Control Using Arduino for Pollution Monitor.”
Mini-Project report Submitted in partial fulfillment of the requirement for the degree of

Bachelor of Engineering

In

Electronics & Telecommunication Engineering

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DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Accredited by National Board of Accreditation Council (NBA) Tier-1



CERTIFICATE

This is to certify that the mini project work entitled “**TITLE OF MINI PROJECT**” is a bonafide work carried out by Sri sumukha (1DS20ET047), Manoj Shastri (1DS20ET044), Praveen Raj (1DS20ET051), Nasir Khan(1DS20ET047) students of 6th semester, Dept. of Electronics & Telecommunication Engineering, DSCE in partial fulfillment for award of degree of **Bachelor of Engineering** in **Electronics & Telecommunication Engineering**, under the **Visvesvaraya Technological University, Belagavi** during the year 2022-23. The mini-project has been approved as it satisfies the academic requirements in respect of mini-project work prescribed for the bachelor of Engineering degree.

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ABSTRACT

Environmental air parameters directly affect our daily quality of life, and they can change from day to day or even hour to hour.

With rapid industrialization over the past few decades, there is a dramatically increasing demand for people to monitor the local air quality to know how they live and what they breathe.

In this work, we proposed an air monitoring system based on the Arduino platform.

This environmental air monitoring system is designed to provide an efficient, straightforward and robust solution to monitor the air quality continuously and in real-time. It is a portable system that integrates multiple sensors into a single unit and can be placed anywhere. The acquired results are displayed on a Phone via Bluetooth model (HC05).

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Air Quality Control Using Arduino for Pollution Monitor - 2023

CHAPTER 1

INTRODUCTION:

The atmosphere is a chaotic system, air condition is influenced by many factors and can change quickly. Air condition and quality directly affect people's daily lives, such as their commute to work and the safety of outdoor activities. With the awareness of more and more serious air pollution in many countries growing, there is an increasing demand for a more efficient way to observe, record and collect air quality data. Usually, people will obtain atmospheric conditions from weather forecasts, but these can only provide limited information in any given location, and are not very accurate. Although there are some advanced systems that might be able to monitor more atmospheric parameters, these systems usually generalize their measurements over a very large area, for instance, monitoring real time parameters for a metropolitan area or a large suburbs using a few observation points. Specifically the combination of O₂ (Oxygen), CO₂ (Carbon Dioxide), rain, temperature and humidity. This makes getting the whole picture in terms of harmful particles, gasses, temperature and humidity very difficult.

Therefore, it is useful to develop a single mobile device that is a fully automated mobile device that can capture measurements at any location for short-term and long-term analysis. This proposed environmental monitoring system can give real time measurements of 4 air parameters

The system integrates O₂, CO₂, temperature and humidity sensors into one single unit and utilizes an Arduino Uno R3 as the controller component. The proposed system provides a user friendly, low cost, and portable solution to monitor multiple environmental air parameters. By incorporating the techniques of sensors and embedded system design, this environmental air monitoring system can provide a convenient and straightforward monitoring method that integrates multiple sensors into a single unit.

This is a portable, user-friendly, low power and low cost air monitoring device that can measure environmental air parameters of interest in real-time. This device can be used anywhere to monitor air quality, including outdoors for industrial air pollution near factories and indoors for home, hospital school use with sensitive populations. The data provided from the device can be used to distinguish between high and low air quality areas.

CHAPTER 2

LITERATURE SURVEY:

1.”Air Quality Monitoring System” by Ramik Rawal

This paper provides the unique IOT architecture for detecting the harmful indoor pollutants like CO,NH₃,dust and smoke (major causes of indoor pollution) along with room temperature and humidity. It also provides the remote access of pollutant levels in the house or office environment for the administrator and process that data and if in case the certain level exceeded then the smart system sends an alert message to the owner. This paper is organized into 5 sections.

First one is introduction which deals with air quality and pollution meanings. Second section consists of literature survey which tells about the effects of harmful gases and also the works done previously. Third section consists of design and implementation of the indoor air quality monitoring system using IOT and GSM. The fourth section consists of result. The fifth section consists of conclusion.

2. ”IMPLEMENTATION OF INDOOR AIR QUALITY MONITORING SYSTEM USING

**IOT AND GSM”- by K.Durga Anudeepika,K.Durga Devi,M.Kamala,D.Swetha,
Dr.E.V.Krishna Rao**

This paper presents a real-time standalone air quality monitoring. Internet of Things is nowadays finding profound use in each and every sector, plays a key role in our air quality monitoring system too. The setup will show the air quality in PPM in webpage so that we can monitor it very easily.In recent years, car emissions, chemicals from factories, smoke and dust are everywhere. That is the reason why now air condition is much polluted. The effect of air pollution is very bad for our health, especially for place where the air in our body is taken for breathing.This research makes human find out which content of the air is polluted. With module node mcu esp8266, we can monitor the air pollution remotely, because there is a Wi-Fi in nodemcu esp8266. This makes the air condition can be monitored every time.

3.”AIR QUALITY MONITORING SYSTEM”- by Arsh Meharwal, Anurag Sharma, Ankit Kumar, Anshul Singhal

This Project will help you to find answers to your questions in the air. Of the four gas sensing devices, which are mainly accountable for the main air pollutants, are available in the system in order to find out what is the best score of any state in the air. The CO₂, CO, and relative humidity are the ones that are most responsible for air pollution, and we had tried to incorporate all of these readings in our system.

The main cause of climate change and human health is pollution in air. This has resulted in changing of climates and, a global energy shortage, the rain, drought, storm, hard rain, fog, etc, for the Living creatures on land and under water, which is suffering from the many problems that life has changed because of the lack of well-being.

4.”A SURVEY PAPER ON AIR POLLUTION MONITORING USING IOT”- by Pattar

Sunil Mahesh. 2 Patil Bhushan Rajendra 3 Bodke Akshay Dnyaneshwar 4 Mr. Ulhās. V. Patil

Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will activate an alarm when the air quality goes down beyond a certain threshold level, means when there is sufficient amount of toxic gasses present in the air like CO₂, smoke, alcohol, benzene, NH₃, LPG and NO_x. It will show the air quality in PPM (Parts Per Million) on the LCD and as well as on the web page so that it can monitor it very easily. It is necessary to supervise air quality and keep it under control for a superior future and healthy living for all. Due to resilience and low cost Internet of things (IoT) is getting popular day by day. With the Industrialization and with the increase in the vehicles on road the atmospheric conditions have considerably affected

5. "Aware of Air: Measuring Local Air Quality using Portable Arduino-based Sensors"- by Nikhil Devanathan

This project aimed to develop, calibrate and test low-cost air quality monitors. By developing monitors that cost about \$100, we can enable the adoption of this technology by tens of thousands of people across the world. Since the monitor is portable, it can be used to measure air pollution indoors, outdoors or in confined spaces. Moreover, by developing a cell phone application (app) for the air quality monitor, the air pollution data can be uploaded to a spreadsheet or database in the cloud. This will make it possible to conduct real-time reporting of localized air quality data from across the country or even across the world. Such a capability is invaluable to respond to accidental chemical spills or industrial emissions, volcanic eruptions, smoke from forest fires, and release of chemical weapons.

CHAPTER 3

OBJECTIVES:

The Major objective of the mini project are:

- To study and understand the process of particle detection by arduino
- Implementation of **gp2y1014au0f Dust and Particulate Matter Sensor** with arduino
- Measurement of the **quality of air** and display them on phone
- Measurement of the **Temperature and Humdity** and display the values on phone
- Make the whole system into a compact model for easy transportation and mobility
- Real time measurement of the 6 data in any place

CHAPTER 4

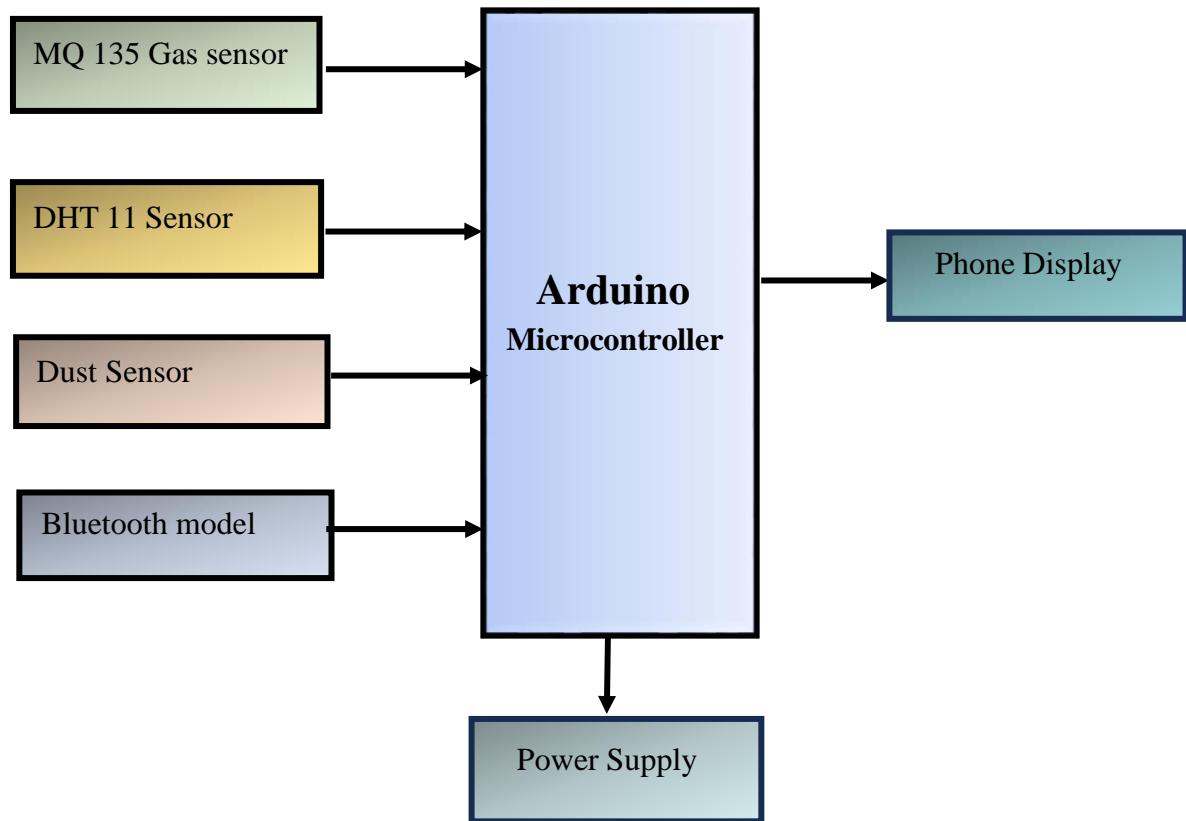
METHODOLOGY:

This system works by collecting data of specific environmental parameters, including gas contents and the amount of dust present in the air. The system has three fixed sensors .The three fixed sensors monitor four types of air parameters: PM 2.5, humidity, temperature, O₂ .

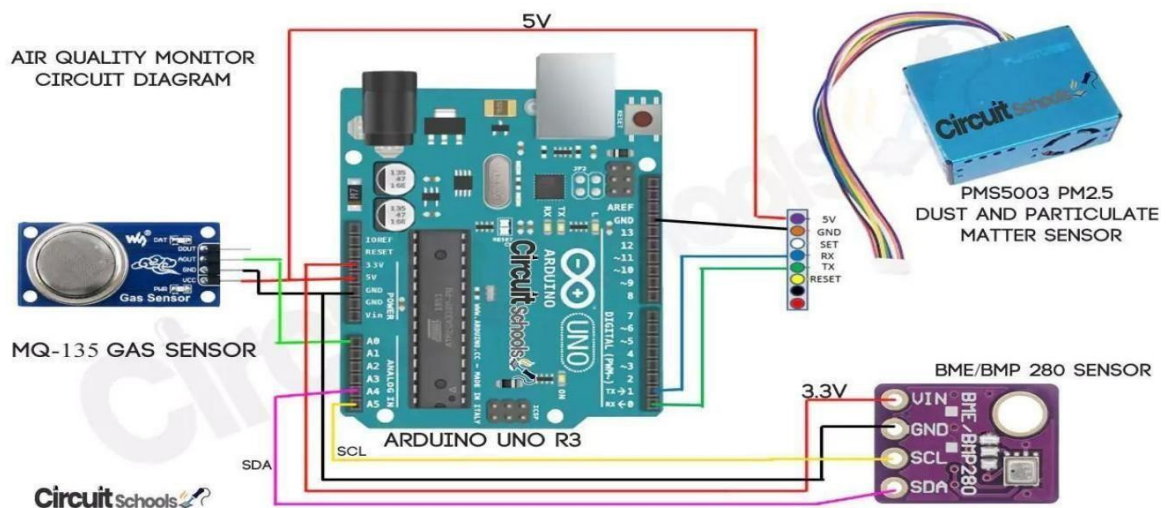
In general, after sensor modules detect the air environmental variables, they generate either analog data or digital data depending on the sensor type for further processing. An analog to digital converter is utilized to convert analog data into a digital signal. The Arduino microcontroller processes all the acquired digital signals and then displays the final results on the phone via using bluetooth model(HC05).

A professional debugging assistant software can continuously receive the incoming environmental parameters from the serial port and store the data.The Arduino micro-controller communicates with the stored data through its serial port. These extracted data can be plotted on a graph, which offers a way to visualize trends over a period of time for changing air environment parameters and historical weather patterns.

Flow Diagram



Chapter 4.1: Flow diagram of the proposed system



Chapter 4.2: Circuit Diagram of the System

HARDWARE REQUIREMENTS:

- Arduino Uno R3
- MQ-135 gas sensor
- DHT11 temperature, humidity sensor gp2y1014au0f Dust and Particulate Matter Sensor HC05 bluetooth model
- Connecting wires

SOFTWARE REQUIREMENTS:

- Arduino IDE(Version 2.0.4)

Sensor details:

>MQ-135 gas sensor:

The MQ-135 is a sensor that is responsible for detecting gasses such as ammonia, alcohol, benzene, smoke and carbon dioxide. It contains basic electronics to be able to interface with a microcontroller, it has 2 outputs, one analog and one digital.

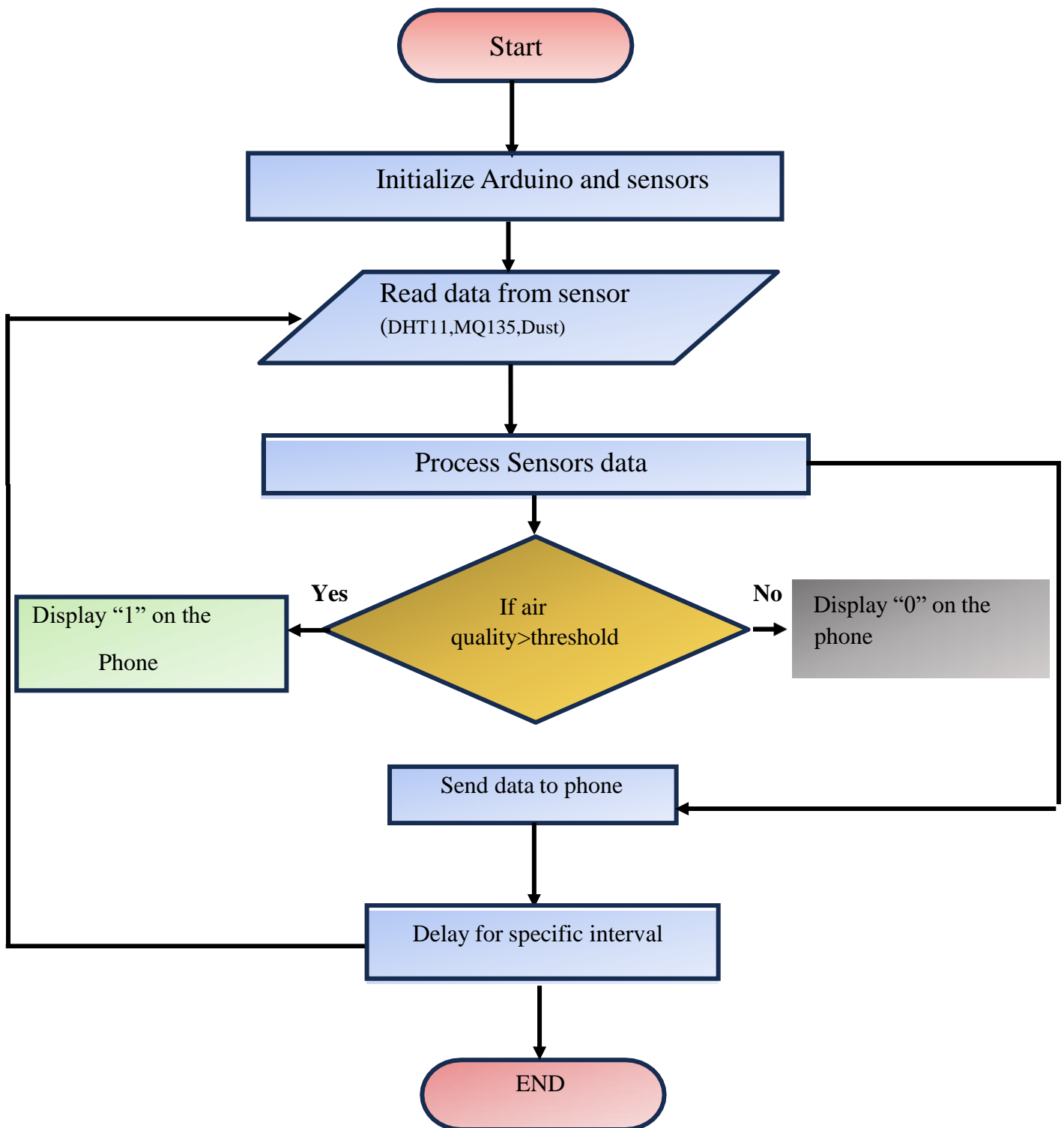
> DHT11 sensor :

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

> GP2Y1014AU0F sensor:

GP2Y1014AU0F is a tiny six-pin analog output optical air quality/optical dust sensor that is designed to sense dust particles in the air. It works on the principle of laser scattering. Inside the sensor module, an infrared emitting diode and a photosensor are diagonally arranged near the air inlet hole

CHAPTER 5



Chapter 5.1: Flow Chart of the Algorithm

ALGORITHM:

1. Start
2. Initialize Arduino and sensors
3. Loop:
 - a. Read data from sensors (DHT11, MQ135, Dust Sensor)
 - b. Process sensor data:
 - Calculate temperature and humidity from DHT11 sensor
 - Determine gas concentration from MQ135 sensor
 - Measure dust particle levels from Dust Sensor
 - c. Check air quality thresholds:
 - Compare temperature and humidity values to desired range
 - Compare gas concentration to acceptable levels
 - Compare dust particle levels to acceptable limits
 - d. Take action based on air quality:
 - If air quality is within acceptable limits:
 - Display "0" on phone
 - If air quality exceeds thresholds:
 - Display "1" message
 - e. Send data to phone:
 - Establish communication with phone
 - Transmit air quality data (temperature, humidity, gas concentration, dust levels) to the phone
 - f. Delay for a specified interval

4. Repeat Loop

5. End

CHAPTER 6

ADVANTAGES AND APPLICATIONS

1. The data collected from air quality monitoring helps us assess impacts caused by poor air quality on public health.
2. Air quality data helps us determine if an area is meeting the air quality standards devised by CPCB, WHO or OSHA.
3. The data collected from air quality monitoring would primarily help us identify polluted areas, the level of pollution and air quality level.
4. Air quality monitoring would assist in determining if air pollution control programmes devised in a locality are working efficiently or not.
5. Air quality data helps us understand the mortality rate of any location due to air pollution. We can also assess and compare the short term and long term diseases/disorders which are a result of air pollution.
6. Based upon the data collected control measures can be devised for protection of environment and health of all living organisms.

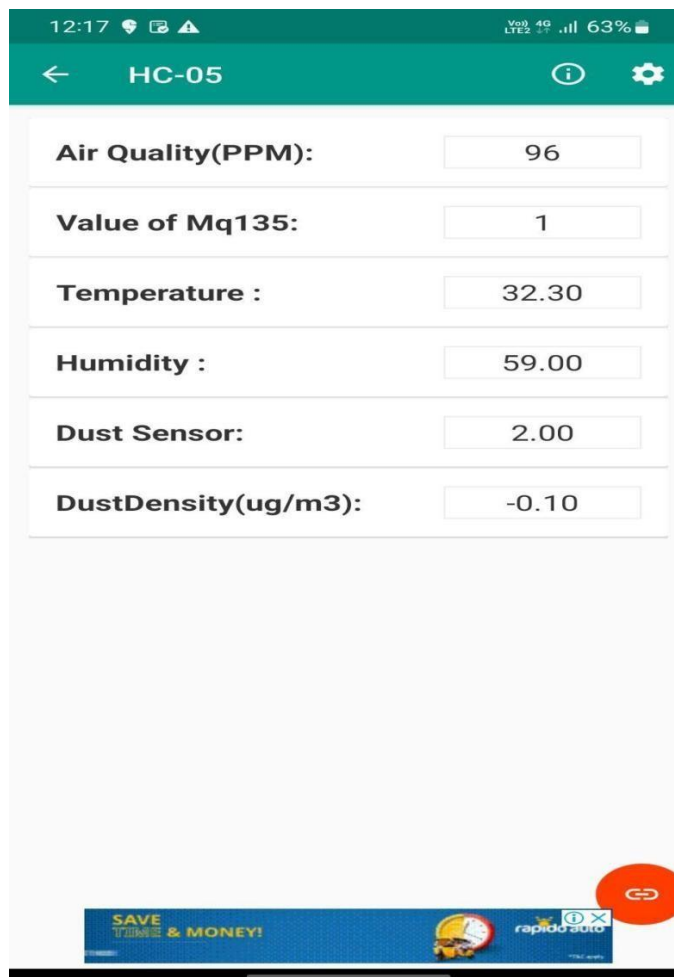
APPLICATIONS:

- 1) Indoor Air Quality Monitoring System
- 2) Outdoor Air Quality Monitoring System
- 3) Particulate Matter Monitoring
- 4) Gas Detection System:

CHAPTER 7

RESULTS:

- The Quality of the Air present is measured in Parts Per Million.
- The Temperature and Humidity of the Air are measured in Real-time.
- Detection of Harmful gases like Carbon dioxide, Ammonia and others are detected.
- The dust Density of the present Air is measured in ug/m3



Chapter 7.1: ScreenShot Of The Output Displayed

CHAPTER 8

CONCLUSION:

In conclusion, implementing air quality control using Arduino offers several benefits and advantages. Arduino provides a cost-effective and versatile platform for measuring, monitoring, and controlling various parameters of air quality. By integrating sensors for temperature, humidity, gas concentration, and particulate matter, Arduino allows for real-time monitoring and analysis of air quality conditions.

Furthermore, Arduino's connectivity options facilitate remote monitoring and control, enabling access to air quality data from anywhere and enhancing convenience. The support of a large and active Arduino community provides valuable resources, tutorials, and assistance for users, making it an accessible platform for learning and development.

Overall, implementing air quality control using Arduino empowers individuals, educational institutions, and enthusiasts to create effective and affordable solutions for monitoring and improving air quality, thereby contributing to healthier and more sustainable environments.

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