# AQI CHECK USING ARDUINO

by


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A project report submitted to

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# BONAFIDE CERTIFICATE

Certified that this project report entitled "**AQI CHECK USING ARDUINO"** is a Bonafede work of **ABHISEK MOHAPATRA 19BCE1790, ISHITA KUMAR 19BCE1551 AND DEEPSI KUMARI 19BCE1064** who carried out the Project work under my supervision and guidance for **CSE2006-MICROPROCESSOR AND INTERFACING.**

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# ABSTRACT

In recent years the Air Pollution levels are increasing throughout the globe. Many diseases are caused due to long term exposure to pollutions like lung diseases, eye irritations and heart diseases. Now these pollutions are reached a level where even indoors and outdoors are not safe, so assessing and monitoring air pollutions levels is a priority in the world. Factors causing air pollution are the increase in usage of fossil fuels, industries, vehicle emissions which affects the human health also. For this situation and to tackle this, a technical way is required to monitor the air quality in real time. It is not possible to collect samples periodically and manually to test the pollution levels. So a solution that can be implemented in real time using Internet of things (IOT) will do the purpose. In this paper the work is focused to transfer information and for the systems to communicate using the internet network protocol.

# ACKNOWLEDGEMENT

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**NAME WITH SIGNATURE** **NAME WITH SIGNATURE**

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# 1. INTRODUCTION

## 1.1. OBJECTIVES AND GOALS

- To monitor the air quality index in PPM using MQ135 Air Quality Sensor.
- To monitor air quality and keep it under control for a better future and healthy living for all

## 1.2. APPLICATIONS

Sampling air quality is an important but difficult task. Hence, we wanted to raise this system to check pollution levels and to take necessary precautions and measures to reduce this for better future and cleaner air.

An air quality list of 500 or more shows that the air is intensely contaminated and will cause irreversible lung harm and a large group of different ailments to each and every individual who is presented to it. Accordingly, to keep away from such circumstances later on, pertinent activities must be executed. IoT mainly consists of a network of smart devices which are processors, sensors, internet and storage. All these devices are interconnected in this network. All of these devices will help us to gather the required information about the air quality and give us a clear picture of how much the air pollution has caused in a place. As well as all the information will be displayed on the webpage for the users and also warns if the pollution levels raise.

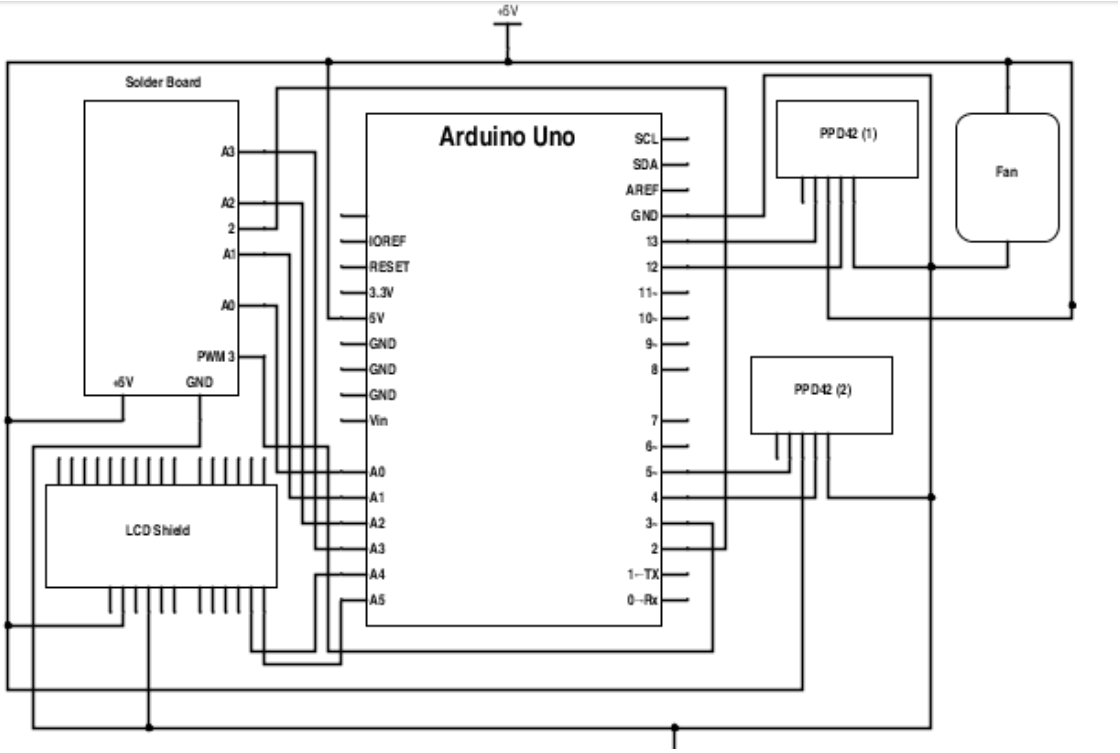
This project aims to create a real time, air quality monitoring system using IoT which will evaluate the pollutions levels in ppm that is present in the atmosphere in any place. The calculated ppm levels (air quality index) will be displayed in a web application .On exceeding the threshold value (normal levels) set, LED lights gets turned on and it gives red light.

### 1.3. FEATURES

For monitoring the air quality, a gas sensor, MQ135 is used. It measures the level of NH3, NOx, alcohol, Benzene, smoke, CO2 in air. The resistance connected to MQ135 is different for various kinds of concentrated gases, so the sensitivity adjustment of components is necessary at time of using. The sensor has wide detecting scope, due to its fast response, high sensitivity, stability and long life. It is mainly utilized in office, buildings and homes for air quality control.

## 2. DESIGN AND IMPLEMENTATION

### 2.1. BLOCK DIAGRAM



**Connection:**

MQ- 2- Gas sensor have 4 pin

u need to use 3 of them as shown in figure pin A0 to pin A0 in arduino pin vcc to pin

5v pin GRN to GRN

• MQ135's voltage and ground are connected to +5V and 0V and analog output pin is connected to analog Pin A0 of Arduino Uno.

- The data pins of MQ135 is connected to Analog Pin.
- The base of 2N2222 transistor is connected to a pwm pin of Arduino Uno and the emitter and collecter of transisitor is connected to the DC Fan and supplied with 9V battery (in Forward Bias). The other connections are kept the same.

Due to its flexibility and employability, an IoT based system has the greater potential to improve living standards in pollution hit areas. Additionally for monitoring, it can be easily set-up and implemented at any place according to the requirement. The present study is based on a cloud based technique with the help of the internet where the sensed data are stored in a simplified manner. The cost of the overall set-up is low and can be fixed for small towns, large part of the countries, even for large indoor environment like buildings and companies. In our project, the ppm values shows the air quality of the region and also gives warning when the threshold value is crossed.

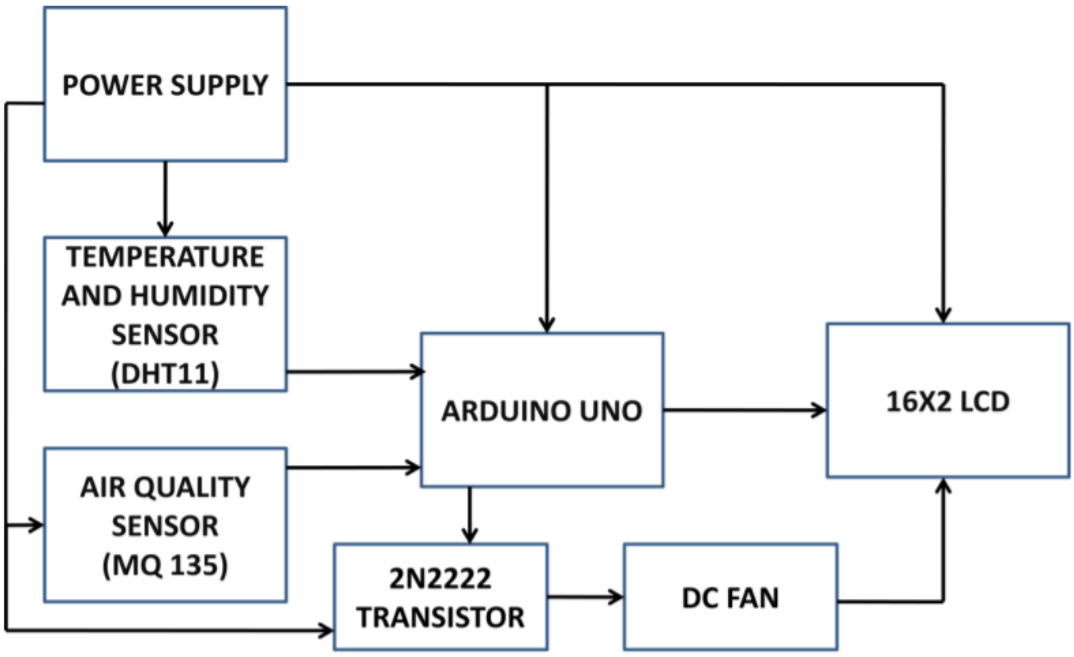



Fig 1(a): Block Diagram of Air Quality Monitoring and Sensing

## 2.2. HARDWARE ANALYSIS

¬ For Different Parameter Sensing:-

• Air Quality sensor (MQ 135)

• 2n2222 Transisitor

• DC Fan

• Potentiometer

• Arduino Uno

¬ For Power Supply:-

• Step down transformer (12-0-12 V,1 A)

• Diodes

• Voltage Regulator (7805)

• Capacitors (0.01 micro Farad, 470 micro Farad)

• Wires

COMPONENT DESCRIPTION:

## a.) Air Quality Sensor (MQ135)

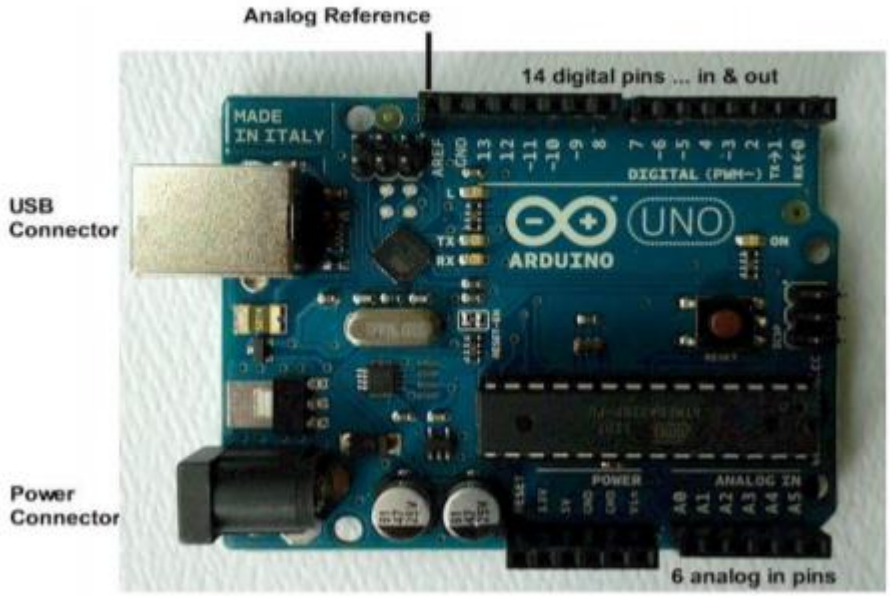

**- Product Description:**

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.

**- 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.

## b.) 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 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.<br><br>5V: Regulated power supply used to power microcontroller and other components on the board.<br><br>3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA.<br><br>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. |

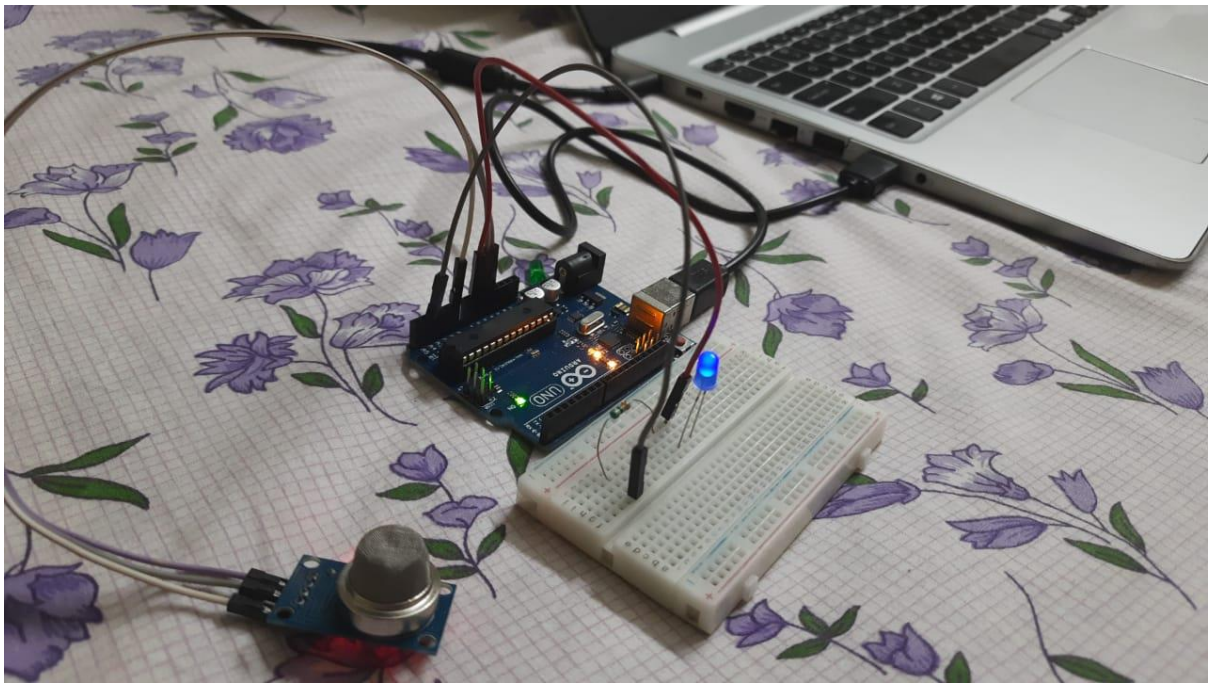
PIN DESCRIPTION OF ARDUINO UNO

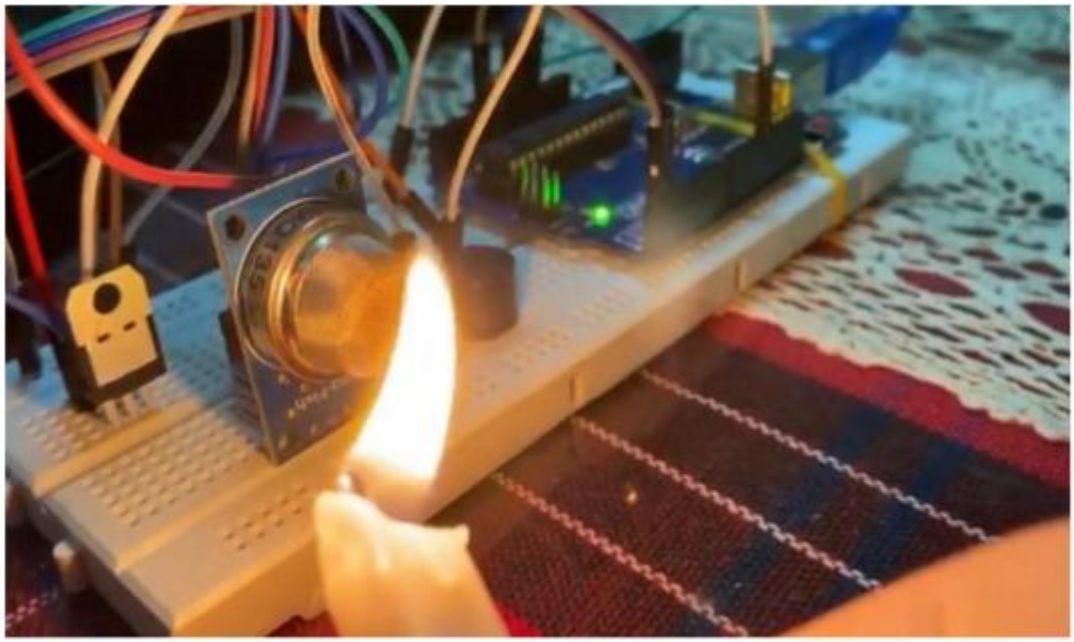
**Technical Specification:**

| | |
|---|---|
| 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

## 2.3. SNAPSHOTS





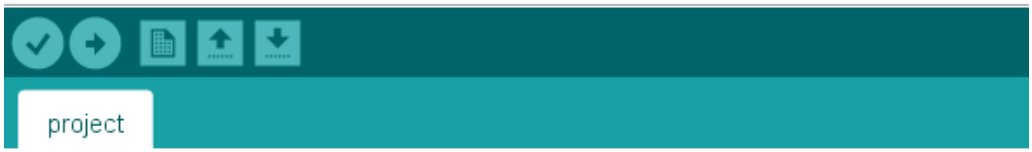
# 3. SOFTWARE

SOFTWARE REQUIREMENTS:

- Arduino (Version 1.8.13)

project | Arduino 1.8.15 Hourly Build 2021/05/31 10:33

File Edit Sketch Tools Help



project

```
int airquality = 0;
void setup()

{ Serial.begin(9600);

}

void loop()

{

int sensorValue = analogRead(A0);
if(sensorValue>100){
    digitalWrite(A3, HIGH);}
Serial.print("Air Quality = ");

Serial.print(sensorValue);

Serial.print("*PPM");

Serial.println();

delay(1000);

}
```

COM5

```
Air Quality = 247*PPM
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## ANALYSIS:

checks the air quality index using the MQ 135 gas sensor and obtains the value in ppm. The system was implemented both on software and hardware. The hardware implementation the system uses an Arduino Uno as the microcontroller unit, along with a gas sensor to monitor air quality, and a Wi-Fi module to connect to the LED. Using Arduino IDE, the programming platform for the Arduino Uno board, the code was programmed onto the Arduino. An ESP8266 Wi-Fi module was used to connect to Thingsboard API via the serial monitor, and the monitored air quality data were sent to the same. In case the quality of air exceeds a threshold i.e. if it is greater than 150 ppm, the LED turn on. The monitored measures and warning messages are displayed on the Thingsboard's dashboard. The software simulation was done with the help of a programming tool - Node red and the obtained values from there was sent to Thingsboard API and then this was interconnected with a webpage.

Once the system is deployed, it checks for the quality of air using gas sensors. This data is then sent to the Arduino Uno for processing. Then this monitored data is sent to the Thingsboard(Serial monitor) API via ESP8266 Wi-Fi module.

According to Air quality index detected (ppm), if the value exceeds the threshold limit i.e. normal levels (greater than 150 ppm) then the buzzer in the system is activated, indicating warning that the quality of air is not supportive.

Air quality index ranges of the air quality are obtained according to the following ranges :

1. 0-50 ppm – Good

2. 51-100 ppm – Moderate

3. 151-200 ppm – Unhealthy

4. 201-300 ppm – Very unhealthy

5. 301-500ppm – Hazardous.

Different LED blinks based on air quality index that was obtained.

# 4. CONCLUSION AND FUTURE WORK

## 4.1. RESULT,CONCLUSION AND INFERENCE

The system has been successfully implemented – Air Quality Index has been continuously monitored via the Gas sensors and the results were successfully obtained in the dashboard after the data is preprocessed and are also visible on the Webpage. As shown in Fig.4, we used a candle for testing values. We brought a candle near to the sensor and checked the variation in the reading. We also used a Agarbhatti and repeated the same process. Also, the LED get triggered when it exceeds the threshold limit of 150 ppm i.e. when the pollutions reach the catastrophic level.

## CONCLUSION:

The proposed system is an implementation of a real-time air quality monitoring system using Arduino microcontroller, IoT (Internet of Things) Technology and a sensor to check and improve quality of air around us.

The system to monitor the air of environment using Arduino microcontroller, IOT Technology is proposed to improve quality of air. With the use of IOT technology enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper. Here the using of MQ135 gas sensor gives the sense of different type of dangerous gas and arduino is the heart of this project which controls the entire process. It supports the new technology and effectively supports the healthy life concept. This system has features for the people to monitor the amount of pollution.

## INFERENCE:

The system to monitor the air of environment using Arduino microcontroller, IOT Technology is proposed to improve quality of air.We have implemented a smart solution that helps to mitigate air pollution outdoors and to achieve a cleaner and safer environment

## 4.2. FUTURE WORK

There are a variety of enhancements that could be made to this system to achieve greater accuracy in sensing and detection. The project can be used as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates. The website used can also be extended into a mobile application. We can also use interface GPS module to monitor the pollution for each location easily. Similarly interface SD card can be added for storing data. MQ135 sensor requires calibration to get a proper output. Hence, it might not be accurate in many cases. To avoid this, MICS-6814 sensor can be used in other models. However MICS-6814 sensor is expensive.

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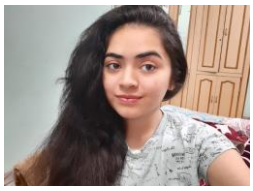

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