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A Real-Time System for Tracking Air Pollution and Quality

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Article Info

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Abstract: Air pollution has recently emerged as a major global issue. A variety of factors, both natural and artificial, contribute to air pollution. The health of humans is greatly impacted by air pollutants, which include atmospheric components such as carbon monoxide (CO), sulfur dioxide (SO2), nitrogen dioxide (NO2), ozone (O3), repairable suspended particulate matter (RSPM), and volatile organic compounds (VOCs). It is affecting the majority of developed-world and developing-world large cities. Consequently, it is crucial to establish a system for monitoring air pollution and quality in real-time. Our team has created an air pollution detector using an Arduino microcontroller and a tiny, inexpensive sensor. Benefits of the detector include dependable stability, quick reaction recovery, and characteristics that prolong its life. This gear is perfect for mobile measurement and easy to understand data collecting; it is inexpensive, user-friendly, low-cost, and requires little power. It comes with processing software that can examine data with great accuracy and quality. Practical tool with potential for business use.

Keywords- Air pollution, ardunio, gas sensor, anthropogenic, atmosphere.

INTRODUCTION

When particles, biological molecules, or other potentially dangerous substances are released into Earth's atmosphere in excess, this is known as air pollution. It is a leading cause of allergic reactions, infections, and even death for some individuals.Animals, crops used for human consumption, and the natural and man-made environments are all negatively impacted [1-2]. Additionally, prolonged exposure to these chemicals or pollutants without protection may cause a variety of cancers in humans, as well as respiratory diseases (like asthma). Carbon monoxide (CO), for instance, is notoriously toxic to humans; prolonged exposure may induce fatal asphyxiation, headaches caused by carboxy-hemoglobin, and other symptoms. In 2014, around 7 million individuals lost their lives due to air pollution, according to the World Health Organization (WHO). The International Energy Agency (IEA) also came at a similar approximation, closely matching it [3]. Many environmental disasters, such as acid rain and ozone depletion, are also caused by these compounds or pollutants. The air we breathe is becoming more polluted due to a variety of human activities, thus finding effective ways to reduce this problem is crucial [4]. Historically, air quality measurement sensors were bulky, immobile, and costly. Currently, the majority of air pollution sensors focus on the five most prevalent air pollutants: particulate matter, sulfur dioxide, ozone, carbon monoxide, and nitrous oxide. The modern world has made air pollution and quality monitoring very important due to the significant impact it has on human health. Localized instances of air pollution may be detected and tracked by the newly-designed air-quality measuring sensor. It is versatile enough to be used inside and out. In the future, thanks to technology advancements, these sensors will be more widely available, affordable, portable, and able to monitor local air quality via wearable devices [5-7].

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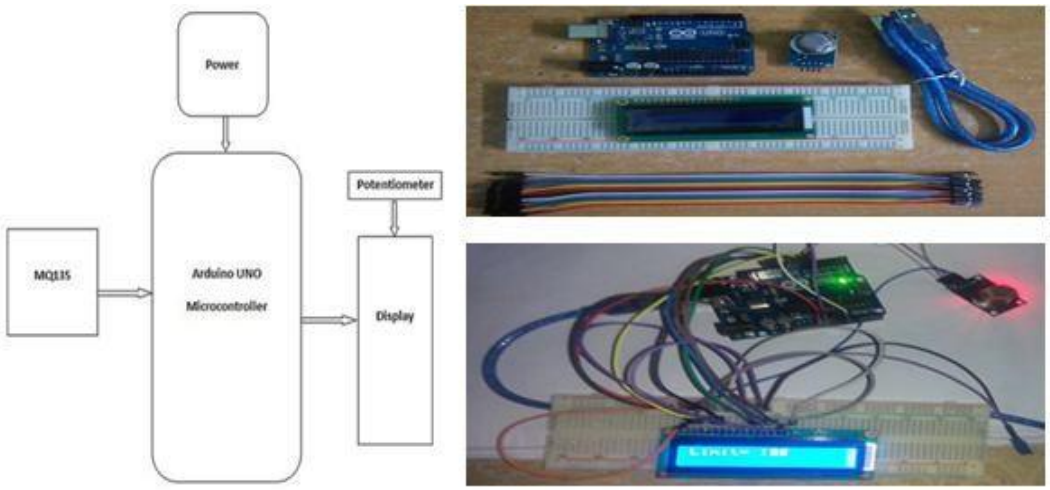
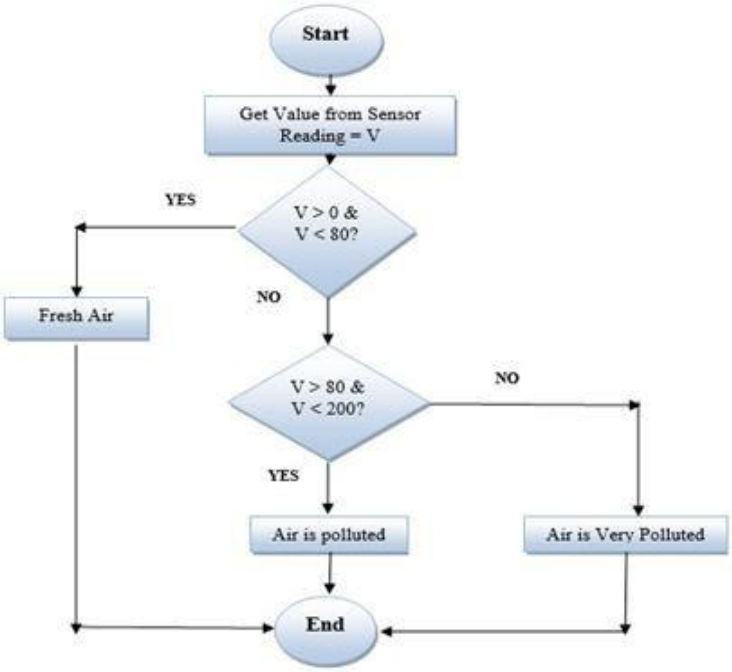
Fig 1: Parts of the air quality monitor system.

I. WORKING PRINCIPLE OF THE SYSTEM

The gas sensing analyzer MQ135 and the system's main chip, the LM393, are both mentioned in references 8, 9, and 10. An up-to-date microcontroller board based on the ATmega328P is the Arduino, also known as Genuino Uno. A USB cable or power source is all that's needed to connect it to a computer. Ready to go when hooked up to a battery supply or an AC-to-DC converter [10, 11]. The MQ135 gas sensor device is connected to the Arduino Uno board via jumper wires. When connected to the Arduino board, the sensor's digital pin should be connected to digital 8 and the analog pin to digital 0. Additionally, the sensor's +5V and GND (ground) pins should be connected to the 5V Vcc and GND (ground) pins on the Arduino board, respectively. Next, a computer system is connected to the arduino Uno board with a USB connection. Detailed below are the detector's structural design, as well as its hardware and software components.





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A harmful gas recognition device for the people, the environment that is appropriate for. A wide variety of gases is detected in air quality sensor comprising NH_3, NO_2, benzene, alcohol, smoke, and CO_2. The collection ofair pollutants like CO_2, CO, SO_2, etc. is greatly location- dependent [3, 6, 9, 12]. Very simple device, and monitoring circuit which is perfect for use in office or factory.

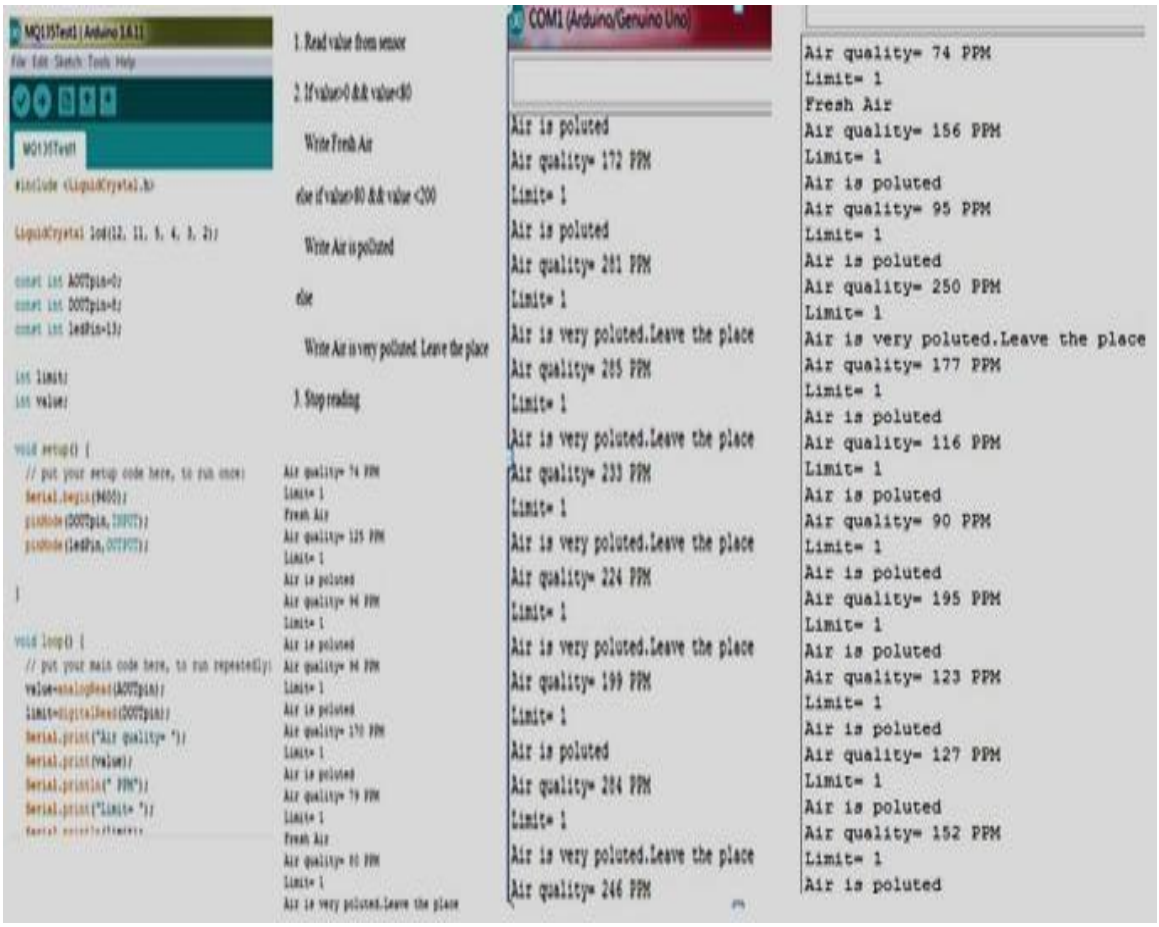
SOFTWARE

We have also developed a customize software s for gathering data from the detector and mapping it in real- time [10, 13]. The software of arduino-based air pollution detector system comprises the coding of the arduino Uno board in its ntegrated development Environment (Arduino IDE). The serial connection between the sensor, the arduino, and the computer system that was formed using the serial library of the arduino. The attention of thegas measured hinge on upon the resistance of the gas sensor. Additionally, this depends on the sensor of thevoltage of the analog output pin. The sensor revisits ananalog voltage to the arduino [11, 14 -15].

II. DATA FROM THE DETECTOR AND CODE

To obtain real time air pollution data (in PPM), we have taken reading using our customized sensor-detector in different environmental pollutions. We have used cigarette smoke, mosquito coil burning smoke, motor vehicle smoke from street etc.

Arduino-Based Real Time Air Quality and Pollution Monitoring System



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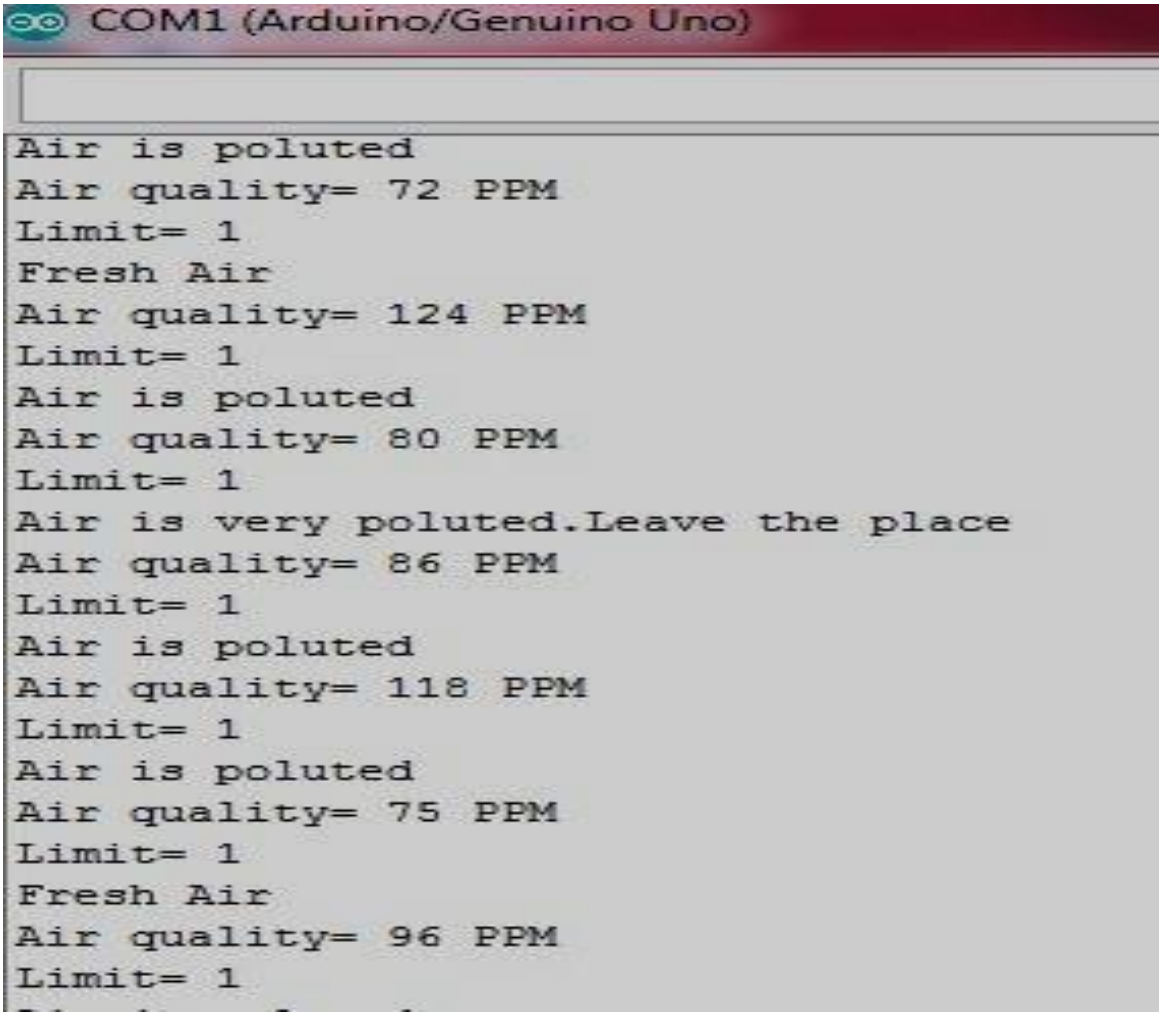

Fig 3: Arduino editor and coding Output Result for mosquito coil, motorcycle smoke and two types of cigarettes Marlboro and Hollywood

III. RESULTS AND DISCUSSIONS

Arduino based air quality monitoring detector system design involves hardware and connection and finally the collection of data from the detector through code for the Ardunio. To obtain real time air pollution data (in PPM), we have taken reading using our customized sensor- detector in different environmental pollutions. We have used cigarette smoke, coil burning smoke, vehicle smoke from street etc. The following values depicts for mosquito coil within 1 meter. From this data analysis we can conclude that for mosquito coil it is safe to be far from thecoil while burning atleast 2 or 3 meters

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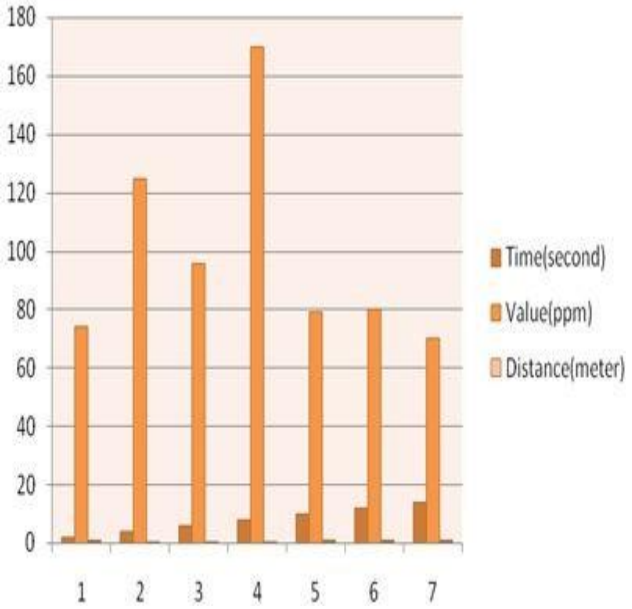
Time(second)	Value(ppm)	Distance(meter)
02	74(Fresh air)	0.5
04	125(Polluted air)	0.3
06	96(Polluted air)	0.4
08	170(Polluted air)	0.2
10	79(Fresh air)	0.6
12	80(Fresh air)	0.55
14	70(Fresh air)	0.8

Time(second)	Value(ppm)	Distance(meter)
02	172(Polluted air)	3
04	281(Very Polluted air)	2.3
06	285(Very Polluted air)	2.2
08	233(Very Polluted air)	2.5
10	224(Very Polluted air)	2.1
12	199(Polluted air)	2.7
14	284(Very Polluted air)	1.9
16	246(Very Polluted air)	1.3



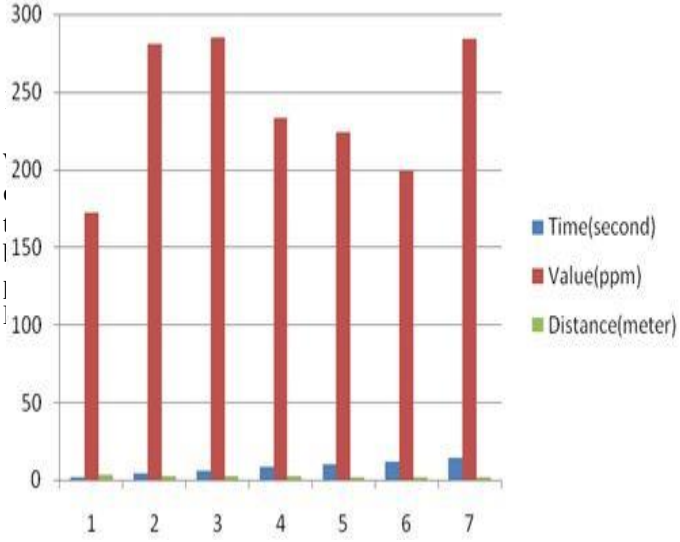


Fig 4: Graphical representation of mosquito coil smoke indetector.

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For motorcycle smoke, we took values within 3 meters. From the values, we can say that the most polluted area thin 3 meters. So, it is safe to keep at least 5-meter distance from the motor cycle when running.

Time(second)	Value(ppm)	Distance(meter)
02	96 (Polluted air)	3
04	127 (Polluted air)	2.5
06	134 (Polluted air)	2.4
08	89 (Polluted air)	2.8
10	118 (Polluted air)	2.2
12	152 (Polluted air)	1.5
14	106 (Polluted air)	1.9
16	177 (Polluted air)	1.3
18	156 (Polluted air)	1.4
20	195 (Polluted air)	Less than 1

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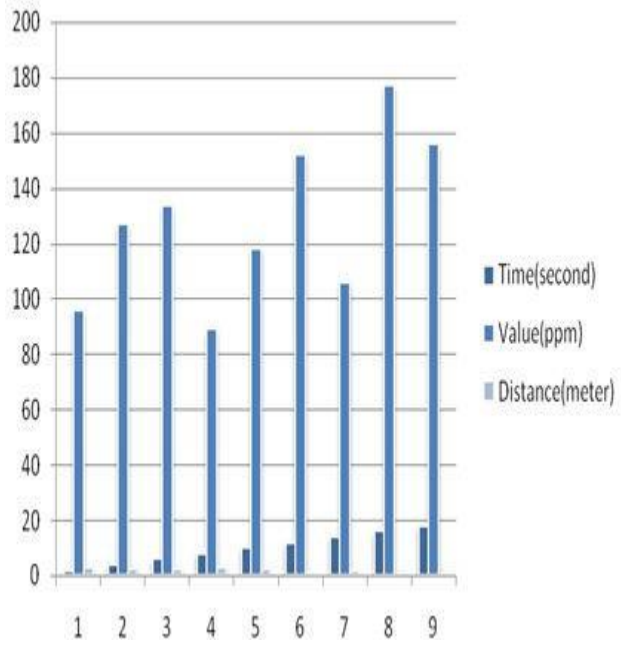
We have defined the system of hardware and software thatmaps in real-time, also the data plotting software is illustrated the standard mechanism monitored by air quality monitoring. Finally, the data collection from the detector system is authenticated. This sensor-based systemcan easily be employed to monitor air quality.

CONCLUSION

We have developed an Arduino based air pollution detector which is a very effective air pollution monitoring system. Based on the performance we can say that it is easy to use, and functionality is comparable to the expensive existing air pollution detectors. It is a microcontroller based portable system. It is efficient and user-friendly air quality detection system.

Conflict of Interest: The authors declare that they haveno conflict of interest.

Ethical approval: This article does not contain any studies with animals performed by any of the authors.



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Source: https://en.wikipedia.org/wiki/Air_pollu tion [8] Air pollution https://en.wikipedia.org/wiki/Air_pollution_sensor [9] and [10] explain how air pollution detectors work.Here is the link to the instructable: http://www.instructables.com/id/Air-Pollution-Detector/).