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Electronic Nose: Biomedical Engineering

Prof. Pratik Tawde
Lecturer
Department of Electronics and Telecommunication Engineering
Vidyalankar Polytechnic Mumbai, India
Corresponding author's email id: *Pratik.tawde@vpt.edu.in*
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Abstract

An odor is composed of molecules, each of which has a specific size and shape. An electronic nose is a device that identifies the specific components of an odour and analyses its chemical makeup to identify it. The electronic nose is a device that detects the hazardous gases which are present in industrial areas. It senses as well as informs the operator such that they are in safe condition.

Keywords: *Sensors, controller and cloud*

INTRODUCTION

An odor is composed of molecules, each of which has a specific size and shape. Each of these molecules has a correspondingly sized and shaped receptor in the human nose. When a specific receptor receives a molecule, it sends a signal to the brain and the brain identifies the smell associated with that particular molecule.

A smell is a neural response to airborne molecules binding to receptors in the mucus membranes of your nose. You can't be harmed by a smell any more than you can by a colour. But the chemical that causes the smell can harm you. In general, we have evolved so that harmful substances smell bad, to warn us. Now, this odor maybe either safe or harmful and for us, our brain does the work of recognizing it.

The electronic nose is a device that detects the hazardous gases out of the specific components of an odor detected by a

sensor and analyses it. Depending upon the application, the most common harmful gases are predefined and stored, such that they are identified. Thereby, they send the gas which has been identified to the operator who is working in or for that area to be alert and hence take further action.
Electronic noses have been around for several years but have typically been large and expensive.

There are various types of electronic noses, as in based on the biological model work in a similar manner, albeit substituting sensors for the receptors, and transmitting the signal to a program for processing, rather than to the brain.

Electronic noses were originally used for quality control applications in the food, beverage and cosmetics industries. Current applications include detection of odor specific to diseases for medical diagnosis, and detection of pollutants and gas leaks for environmental protection.

The electronic nose is a device that detects the smell and tries to match as efficient and accurate with the human sense of smell. An electronic nose consists of special sensors which are specially used for odor detection. The electronic nose is an intelligent sensing device that uses an array of gas sensors with an open source electronic based platform, Arduino.

Nowadays, the electronic noses have provided external benefits to a variety of commercial industries, agriculture, biomedical, cosmetics, environmental, food, water and various scientific research fields.

The electronic nose detects the hazardous or poisonous gas which is not possible to human sniffers to identify whether the gas is dangerous or no.

In all industries, odor assessment is usually performed by human sensory analysis, by chemosensory, or by gas chromatography. Mainly, in industries there are exhaust gases, which are emitted during combustion process. The exhaust gas is actually a combination of many different gases: N2, CO2, H2O and O2. Though some are harmless, there are few that are harmful and are considered major pollutants.

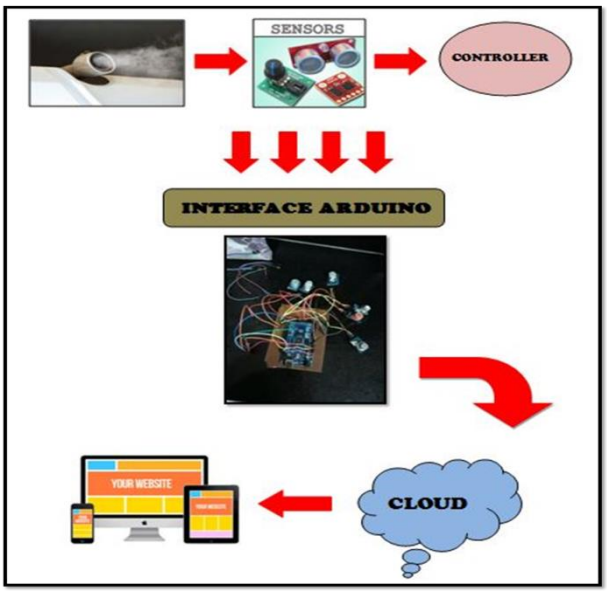
One of the most dangerous of these is CO, carbon monoxide. This gas has the potential to kill people and animals if concentrations are high enough. Hydrocarbons come from unburned fuel.

Nitrogen oxides are released through the internal combustion process and have been linked to acid rain and ozone. Exhaust gases can be visible or invisible to the naked eye.

We inhale airborne particles that enter our respiratory system and fasten in our lungs. This can affect human health in both the short and the long term. The consequences for our health are alarming Day by day the fresh air of the environment is getting polluted because of the mixing of particulates, biological molecules, and other harmful materials. Such polluted air is causing health problems, diseases and death.

Figure:-1

BLOCK DIAGRAM



The first thing people see, in the morning, when they walk outside is the sky or the colored sun. Is this world giving us the privilege of seeing the natural colors of the sun through all the layers of pollution within the air? Not only are beautiful sights such as this hidden behind the pollution this world causes every day, but an increase in diseases, infections and death occurs.

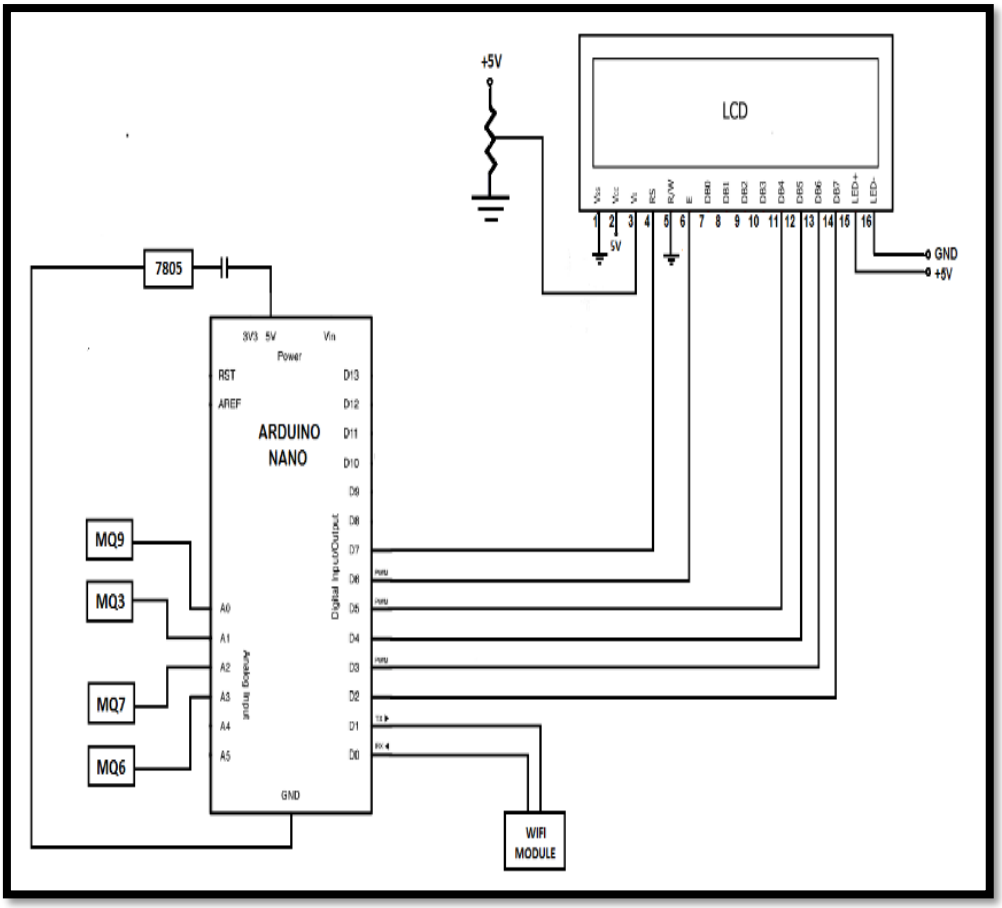
The release of such air pollutants in heavy concentrations such as smog, particulates, solid materials, etc are getting settled over the city, causing air pollution and health hazards to the people. Lots of dirty wastes produced by people on daily basis especially in the big cities polluting the whole atmospheric air to a great extent.

The release of gaseous pollutants from burning fuel of motor vehicles, industrial processes, burning of garbage, etc are contributing to the air pollution. Some natural pollutants like pollen, dust, soil particles, natural gases, etc are also the source of air pollution.

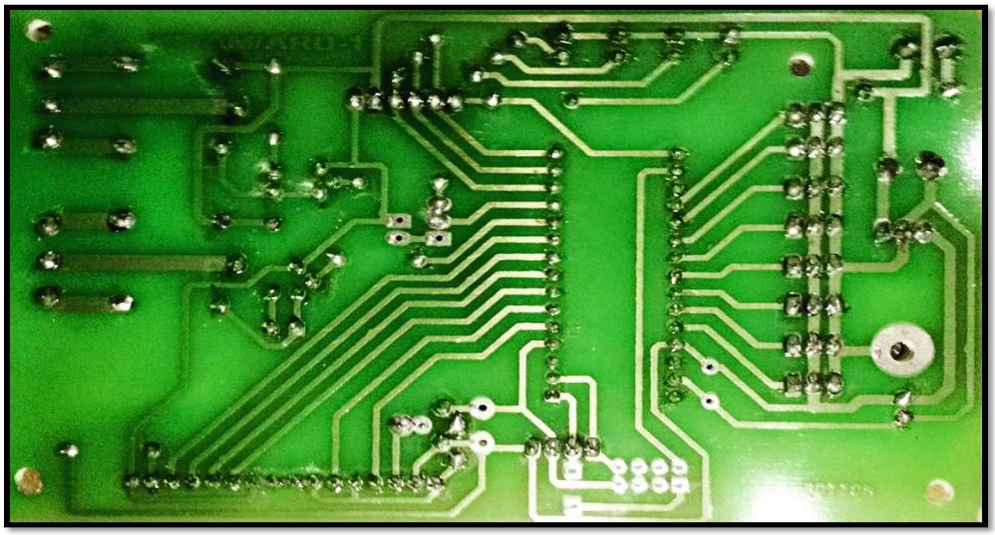
There are so many harmful gases in the atmosphere which are caused by not only industrial processes but due to various reasons.

Figure:-2

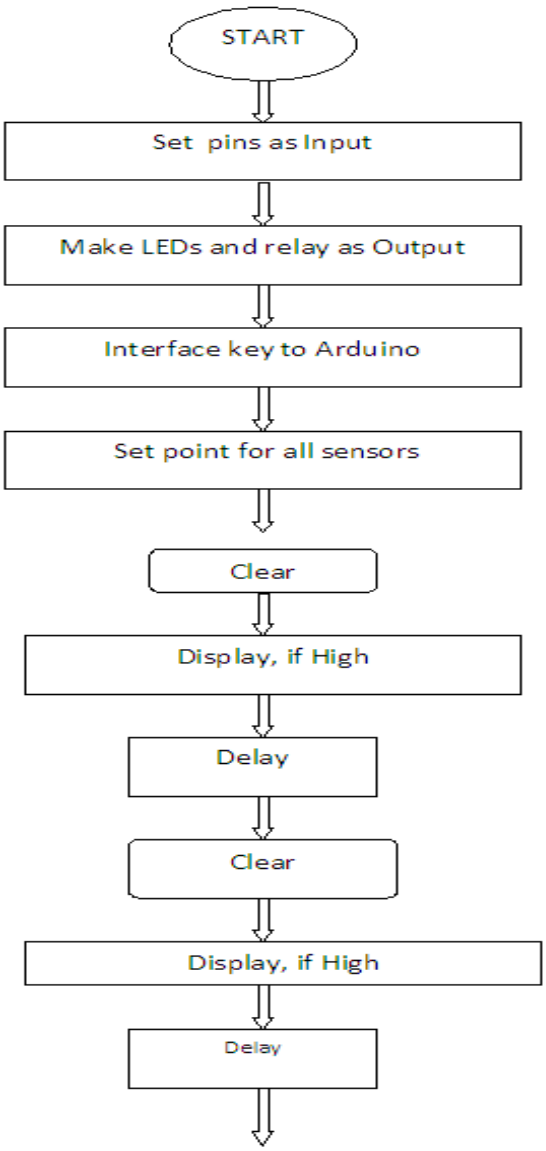
HARDWARE DESIGN



CIRCUIT SIMULATION



Flow Chart



Advantages

- Inexpensive circuit.
- No loss of human life: human life has no risk because of this use.
- Resources required are easily available: required materials for this system are easily available.
- Portable device: device is portable because of its small size.

Disadvantages

- Bulky nose.
- Extremely sensitive sensors.
- Maintenance is difficult.

- Repairing of sensors or WIFI module is not possible.

Applications

- The detection of dangerous and harmful bacteria's.

- The detection of lung cancer or other medical conditions by detecting the volatile organic compounds that indicate the medical condition.

- Used for domestic purpose for household safety.

- Used in industrial areas i.e; mining purpose.

- Detection of contamination, spoilage, adulteration.

- The quality control of food products as it could be conventionally placed in food packaging to clearly indicate when food has started to rot or used in field to detect bacterial or insect contamination.

Future Expansion

- The ability of the electronic nose to detect odorless chemicals makes it ideal for use in the police force, such as the ability to detect drug odors despite other airborne odors capable of confusing police dogs. However this is unlikely in the near term as the cost of the electronic nose would be quite high.

- It may also be used as a bomb detection method in airports. Through careful placement of several or more electronic noses and effective computer systems, one could triangulate the location of bombs to within a few meters of their location in less than a few seconds.

CONCLUSION

This will make it easier to understand the concentration of the gas present and has to be detected.

Thereby understanding and differentiating the harmful gases. Therefore, it will protect human life.

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