

# Vacuum Decomposition

Using **arduino powered modules** and **vacuum chambers** for treatment

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**Abstract**— The least worry of a man should be the safe surrounding he resides, the experiment aims to provide a solution to minimize the junk either be plastic or any form of non-corrodible waste. The aim is to provide a ground like the pressure and gravitational conditions that is present outer space or at least mesosphere.

Here the science behind is simple, but rarely utilized as the cost cutting and module preparation is not a mere group assignment but a very time consuming largely funded, man powered project, that possibly be the current solution for earths unending problems.

While each stages of the process the group considers the emission of poisons gases while the junk is being treated, usually the observed gases are methane and carbon monoxide, hence using MQ-4, MQQ-7 respectively, this ensures the release of these gases are done after treatment. The modular form for the initial collection of the material is an arduino controlled module that is observant of its surrounding, working along the defined perimeter of its own. Using the capability of an ultrasonic sensor it determines its path. The final stage conducts the transfer of the collected material under high pressure is placed into the chamber that carries of the decomposition using the passage of Uv rays.

**Keywords**—*Arduino Uno, Ultrasonic sensor, MQ-4, MQQ-7*

## Introduction (Heading 1)

The existing technology to possibly degrade plastic as well as other waste in our environment seems to have failed tragically. As time passes it is clear that the pile up is crushing down cities as well as altogether nations, as creators of such materials it right only for us to bring change to the current situation.

Now in similar studies that have been conducted before the results are vague, yet it is observed that junk undergoes chemical changes while it is preserved in vacuum conditions. The system is turned brittle once it is put into a condition where the pressure conditions are way below 1% that of which at the sea level.

The settling of junk into the proposed chamber where the induced pressure conditions will be instigated. This is a time-consuming stage and the results in the end fluctuate from reprocessing to finished simple decomposed form of materials.

The passage of the Uv rays is the final step in converting the already under pressure junk material. It minimizes the byproduct formation and toxicity of gases formed is checked after this is carried out.

The process of involving vacuum to degenerate a chemical bond itself is a herculean task, matching the pressure conditions of the chamber to the required conditions for the up taken plastic is the next challenge.

Plastic material break their bonds when they are under UV-rays, as we know UV-rays travel in vacuum, in the proposed medium the inducing condition allows the vacuum chamber to out gas the material placed in it, during which the travelling rays can continually eradicate the chemical bonding. The process involves using the junk that is under different conditions than that readily available to it. It tends to see if any active form of junk can withstand vacuum conditions and if not when brittle what can be done to sustain the evolved gases whether be poisonous or not.

## Methane Gas Sensor MQ-4

This semiconductor gas sensor detects the presence of methane (CNG) gas at concentrations from 300 ppm to 10,000 ppm, a range suitable for detecting gas leaks. The sensor's simple analog voltage interface needs only one analog input pin from your microcontroller.

This methane gas sensor detects the concentration of methane gas in the air and displays the reading as an analog voltage. The concentration ranging from 300 parts per million to 10,000 parts per million is suitable for leak detection. For example, the sensor could detect if someone left a gas stove on but not lit. The sensor can operate at temperatures ranging from -10 to 50°C and consumes less than 150 mA at 5 V.

SnO<sub>2</sub> is the sensitive material of MQ-4 sensor. When the target combustible gas exist, the sensor conductivity increases along with the rising gas concentration.

MQ-4 gas sensor is highly sensitive to Natural gas, Methane and Propane. The sensor could be used to detect different combustible gas especially Methane, it is of low cost and suitable for different application.

### Features

- High sensitivity to Combustible gas in wide range
- High sensitivity to Natural gas Methane, Coal gas, CO etc gas
- Fast response
- Wide detection range
- Stable performance
- Long life
- Low cost
- Simple drive circuit

### Applications

- Domestic gas leakage detector
- Industrial Combustible gas detector
- Portable gas detector
- Gas leak alarm



Figure1: pin diagram for MQ-4 methane gas sensor.

### Carbon Monoxide Sensor - MQ-7

This is a simple Carbon Monoxide (CO) sensor, used for sensing CO concentrations in air. The MQ-7 can detect CO-gas concentrations anywhere from upto 20 to 2000ppm. It is a portable gas detector.

This sensor has a high sensitivity and a very fast response time. The sensor's output is an analog resistance. The drive circuit is very simple, all you need to do is to power the heater coil with 5V, add a load resistance, and then connect the output to an ADC.

Sensitive material of MQ-7 gas sensor is SnO<sub>2</sub>, which lower conductivity in clean air. It make detection by method of cycle high and low temperature, and detect CO when low temperature. The sensor's conductivity is higher along with the rise in gas concentration. When high temperature, it cleans the other gases adsorbed under low temperature.

MQ-7 gas sensor is highly sensitive to Carbon Monoxide. The sensor is used to detect different gases contains CO, it is cheap and is suitable for different applications. It is a portable gas detector.

### Character

- Good sensitivity to Combustible gas in wide range
- High sensitivity to Natural gas
- Long life and low cost
- Simple drive circuit

### Application

- Domestic gas leakage detector
- Industrial CO detector



Figure 2: MQ-7 Carbon monoxide sensor

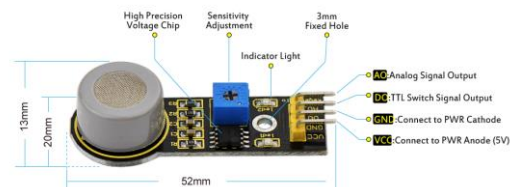


Figure 3: pinout for MQ-7

### Ultrasonic Sensor

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules. The ultrasonic sensor uses sonar to determine the distance to an object. Here's what happens. The transmitter (trig pin) sends a signal: a high-frequency sound. When the signal finds an object, it is reflected and the transmitter (echo pin) receives it.

## Features

Here's a list of some of the HC-SR04 ultrasonic sensor features and specs:

Power Supply : +5V DC

Quiescent Current: <2mA

Working Current: 15mA

Effectual Angle: <15°

Ranging Distance : 2cm – 400 cm/1" – 13ft

Resolution : 0.3 cm

Measuring Angle: 30 degree

Trigger Input Pulse width: 10uS

Dimension: 45mm x 20mm x 15mm

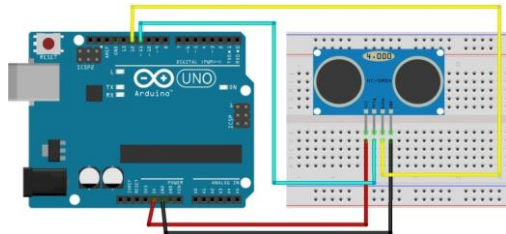


Figure 4: Ultrasonic sensor being connected to the Arduino Uno

## Arduino Uno

The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows serial communication on any of the Uno's digital pins.

### 1) Automatic (software) reset

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100nF capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

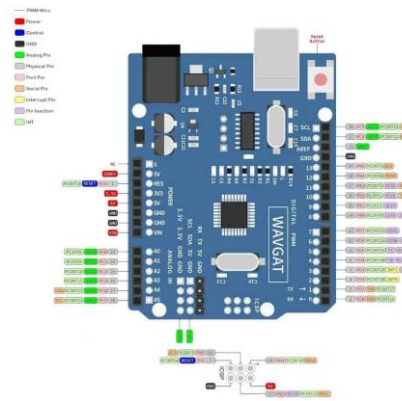


Figure 5: Pin diagram for an arduino Uno

## RESULTS

### Stage one

The output observed here is active form of junk after the material is under high pressure and gravity

### Stage 2

The output here is brittle form of plastic which is passed out and the gases released due to pressure development

### Stage 3

The byproducts that can do one more cycle of vacuum decomposition can help it to form brittle.

Output required from the module:

Searching for junk and containment along with avoiding obstacles that can cause damage for the module itself. Monitoring the device will also be a solution for the same.

### Future scope

Plastic is an important material which has wide range of uses and is an important material to our economy. We require plastic products for our daily life. It is cheap and very versatile. It is difficult not to depend on plastic. But this comes with a cost. Most of the plastic items we use are non-biodegradable. And most of them takes thousands of years to decompose.

Plastic products are one of the main sources of pollution. Accumulation of plastic products in the environment causes pollution. This can affect the land and also the water bodies. Many of the Marine animals are harmed by injection of plastic materials thrown in the water bodies.

The process of production of plastic can cause carbon emissions which highly contribute to global warming. Lot of energy and resources are required to make plastic and most of them are produced from fossil fuel resources. Carbon dioxide, which is produced during the production of plastic is a greenhouse gas which significantly contribute to global warming.

Burning of plastic can also lead to environmental pollution due to the release of harmful gasses. These gasses can also cause harmful

diseases in living organisms including humans. When inhaled they can also cause respiratory problems.

Due to all these harmful consequences it is necessary to limit the use of plastic and also to find a proper way to get rid of it. If we are able to decompose plastic without causing any harmful effects on the environment, then it can solve the issues we face with pollution to a great amount.

Using vacuum decomposer is the best way to achieve it. We can create modules which take in waste. These modules will have vacuum conditions which is almost similar to mesosphere. After plastic materials are taken into it, U-V rays are passed into it and the plastic is made brittle and is decomposed without causing any harmful effects to the environment. There should be specific areas in each city where plastic can be collected and passed into the vacuum decomposer. This is the best way to get rid of plastic materials taking any toll on the environment or on the organisms living on it.

By doing this, we can increase the lifespan of our earth, thereby increasing our lifespan.

The problem the environment was facing so far with not having an alternate solution to solve the accumulation of junk around us, the module tends to solve the worry in this manner to provide a mechanism to get the trash spilled collected and the eradication of it itself. Each module can only carry some definite amount of material which requires a certain amount of monitoring hence this doesn't even reduce manpower in fields, hence ensuring employment. The issues we faced till today as discussed with regards of plastic and other waste materials will be completely changed and remodeled using this technology.

### **References**

- [1]INSPEC Accession Number: 5623021, D.L. Schweickart
- [2]INSPEC Accession Number: 15556047 Alexander Dicks, Volker Lohweg, Henrik Wittke, Stefan Linke
- [3]INSPEC Accession Number: 18329648I, Theodore G. van Kessel, Muralidhar Ramachandran
- [4]INSPEC Accession Number: 9163255, A. Ghita, A. Aciu, G. Pitl

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