# Team Name: PURITY

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## Abstract:

Air pollution has become the world's single biggest environmental health risk, linked to several deaths according to a recent World Health Organisation (WHO) report. The new data further reveals a stronger link between, indoor and outdoor air pollution exposure and cardiovascular diseases, such as strokes and ischemic heart disease, as well as between air pollution and cancer. The role of air pollution in the development of respiratory diseases, including acute respiratory infections and chronic obstructive pulmonary diseases, is well known. While both indoor and outdoor pollution affect health, recent statistics on the impact of household indoor pollutants (HAP) is alarming. The WHO factsheet on health states that 3.8 million premature deaths annually - including stroke, ischemic heart disease, chronic obstructive pulmonary disease (COPD) and lung cancer are attributed to exposure to household air pollution. Use of air cleaners and filters are one of the suggested strategies to improve indoor air quality. This report deals with the benefits of air filters in improving indoor air quality.


## Introduction:

The quality of air we breathe determines the health of the lungs as well as other organs. Indeed, clean air is considered to be a basic requirement of human health and well-being. However, air pollution continues to pose a significant threat to health worldwide. Indoor air pollution is a complex mixture of pollutants migrating indoors from outdoor air and pollutants generated by indoor sources. Air is commonly filled with harmful allergens, dust, pollen, pet dander etc. Air filtering is one way to minimize the harmful dust particles present in the air. Electrostatic Negative ion generator uses the unique Corona Discharge that ionizes nearby

dust particles and makes sure that the air we breathe is ultra clean. The air filter keeps a watch on the environment we live in. It releases negative ions into the air which traps the minutest allergens like dust, dirt, pollen etc and settles them down. Moreover, negative ions help us feel relaxed and rejuvenated. In addition, it uses minimum input power that makes the environment clean and hassle free.

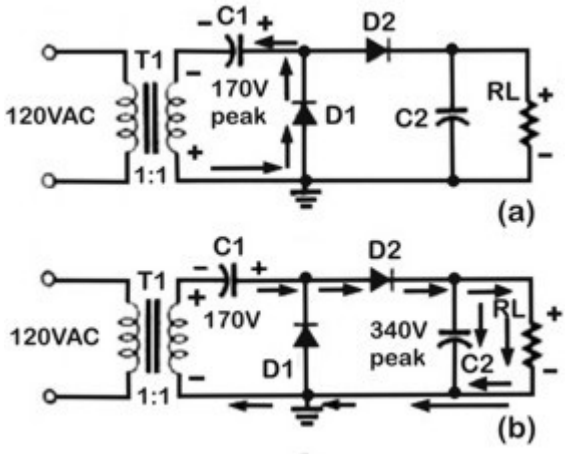
## Motivation:

As per the analysis of WHO, people have become so sensitive that they are more commonly effected by allergies majorly in the crowded cities like Bangalore and Delhi. WHO says that 80-90% of patients are due to allergic mites. So it's our (mainly engineers) duty to make a change in their life so that they can live comfortably. So here we present an idea where people can live in a healthy environment.

## Methodology:

Negative ions are air molecules with one or more excess electrons, and can produced artificially by a low-power, high voltage (about 5 to 14-kilovolt) DC supply. The positive terminal is grounded, and the other (the emitter) is a needle exposed to air. Extra electrons on the emitter's surface produce a high local electric field owing to its pointed shape. The electrons exit the emitter needle's surface due to the polarization of surrounding air molecules between the emitter needle and ground. The electrons collide with the air molecules and produce negative ions.

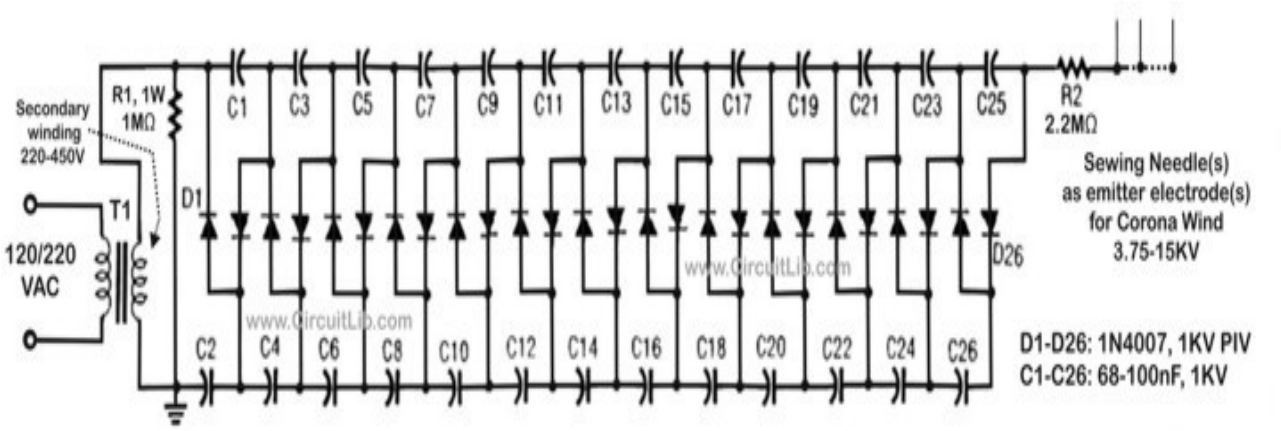
What actually causes electrons excitation (corona) is the high electric field at the tip which is directly proportional to the voltage and is enhanced by sharpening an electrode tip to a fine point. The high electric field strains the air molecules polarizing them by a phenomenon called dipole polarization. Air molecules are forced to accept electrons creating negative ions.




The negative ion generator circuit

The negative ion generator is based on cascaded half-wave voltage doublers. The biggest advantage to using voltage doublers is that they use inexpensive low-voltage parts. The basic half-wave voltage doubler is presented in Figure 1.

Regarding Figure 1, we'll assume that C1 and C2 are initially discharged. During the first half-cycle shown in a, the upper input terminal is positive and the bottom negative, so D1 conducts and Cl charges to about V*√2 =170volts peak. Diode D2 can't conduct, since it's back-biased, so C2 discharges through RL. In the second half-cycle (b), the analysis is similar, except that D2 conducts and C2 charges. The circuit is really a transformer less voltage amplifier. While T1 can provide isolation, as well as increase the AC voltage initially going into the doubler, the amplification due to the doubling action would occur without it. When the polarity reverses, both the input voltage and the charge across C1 are in series like two batteries, producing about 2*V*√2=340 volts peak. A negative ion generator can be built using cascaded voltage doublers, as shown in figure 2 and adding one (or more) sewing needle(s) as an emitter to generate "corona wind."




The circuit delivers 3.75 kilovolts DC when powered from 120 volts AC, 7.5 kilovolts DC when powered from 240 volts AC, and 12.5KV when powered from 400V AC.

## Social Impact:

Air filtration technique described above can remove air pollutants and effectively alleviate the deterioration of indoor air quality. Moreover, the negative ion generator described here is low-cost and easy to build. It generates high voltage, but at very low current. This makes it economical and cheap. It further helps in achieving sustainable and healthy building ventilation. As one of the world's most populous countries, India has seen a significant rise in incidence of respiratory diseases such as asthma over the last decade. Air filters when employed in large scale helps in reducing the burden of asthma. Air pollution can also cause long-term damage to nerves, brain, kidneys, liver, and other organs. It is also

believed that air pollutants cause birth defects. Use of these air filters helps in reducing birth defects.

## Market Survey:

Majorly in the cities like Delhi, Calcutta, Mumbai, Bangalore, where there is more population as well as pollution, these major cities can be targeted to introduce our product. This product helps to maintain good healthy environment. As it involves generation of high voltage, we need to use some standard materials to build this product. Though the cost of the product is a bit high, it can contribute a lot towards building of pollution free environment. We can certainly look forward to overcome this problem and introduce this product into the market. For example, we have several government schemes related to health and by using these schemes we can introduce this product into market. Moreover, the main aim of government is to set a pollution free nation. As per the analysis, people living in metropolitan cities have more respiratory problems due to air contamination. So, we have higher probability of success in these areas.