Equipment for Air Pollution Control

Submitted in partial fulfillment of the requirements Of
the degree of

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

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2020

CERTIFICATE

This is to certify that the Research work titled **Equipment for Air Pollution Control** that is being submitted by **Sumit Kumar (1614101174), Manish Kumar Teotia (1614101090), Prashant Peelwan (1614101211), Rishabh (1614101140)** is in partial fulfillment of the requirements for the award of Bachelor of Technology, is a record of bonafide work done under my guidance. The contents of this research work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma.

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ACKNOWLEDGEMENT

The contributions of many different people, in their different ways, have made this possible. I would like to extend my gratitude to the following.

We are grateful to my supervisor **Dr. P Mathiyalagan**

(Department of Mechanical engineering)

ABSTRACT

Decreasing the pollution of level is now the main aim for many. Pollution is in many forms; almost every natural thing is now affected by the term pollution. Not only land, Water, air, but each and every thing belongs to the planet is now in danger levels of pollution. Already human civilizations woke up to reduce this danger but are not into many things one of such is air. Air pollution is one of the hardest challenges to the humans as it is beyond our hand limits. So there must be a technology for that to decrease the alarming levels of air pollution back to the bottom. In this method the air is being purified by the use of distilled water only, without the use of any synthetic material and/or chemical substance. Here, the air is made passed through the water so by reaction with water, Pollutants stay in it results in clean air. In this method air is being is purified by pollung water, but the fact is cleaning water is easy thing. There are many methods for this but cleaning air needs some boost up in the technology level.

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INTRODUCTION

Pollution is one of the biggest disasters which world is facing right now. Population and the respective technology in current scenario are only making our surrounding even worse. Researchers and engineers are on their full scale to bring the danger level down but are still not at their desired point. Some facts say by global warming (a main indicator of pollution) some of the countries like Miami of South-Florida, Texas will be completely submerged under water by the end century i.e. the ice melting in such a faster way that the sea level increasing rapidly. This is just an example which explains that pollution is such a monster that will eventually end life on Earth. A lot of dangerous diseases are caused due to it and is leading to the deaths of many. Many countries and larger cities in the world are struggling with severe air pollution today. Factories, Vehicles and use of non-renewable energy pollutes the air around the cities of India. This is major problem, the polluted cities in these countries are home to more than 1 billion citizens. The solution that people use to clean the indoor air in the polluted areas are called air purifiers. It is a device that the most people are affected by poor air quality keep in their homes and offices. The air purifiers function is usually to create an airflow in the home by suction fan inside the device. The air then passes through some sort of filter media which traps the polluted particles, and out comes clean air. However most air purifiers in the market today are using a so called HEPA filter, which need are – placement every few months and consume a lot of energy. This solution is rather costly and is not suitable for everyone since one of the most important factors to customers when buying an air purifiers is the price. An air purifier is also a part of the furnishings in a home which also makes the aesthetic design of the air purifier important.

Literature review

This article discusses primary and secondary particulates with respect to their size distribution, origin, and chemical composition. Primary particulates are particles that are injected directly into the atmosphere. Usually their sizes are within the range 1 to 20 jum. Common sources are windblown soil, industrial emissions, and combustion systems. Examples of typical primary particulates are soot, pollen, fly ash, and dust. Secondary particulates are relatively small; their size range is 0.01 to 1.0 nm. They can be generally classified as sulfates, nitrates, or hydrocarbons. Secondary particulates are formed as a result of atmospheric reactions involving gaseous species such as SO2, NO*, O2, NH3, H2O, and hydrocarbons. The proposed mechanisms for a number of these reactions are outlined and their relative importance is discussed. The impact of both primary and secondary particulates on health and esthetics is also discussed.Particulates can be defined as dispersed matter that exists in the condensed phase (either solid or liquid) in which the individual units have sizes that range from 0.005 nm to about 500 fim. The size limits are somewhat arbitrary but are meant to indicate that particulate species can be as small as a cluster of several molecules or they can be as large as visible dust kernels. Particulate matter is extremely varied as to its chemical and physical properties. Very fine particulates behave almost like a gas or vapor; they are subject to Brownian motion, follow fluid streamlines, and are capable of coagulation and condensation. Larger particulates are more characteristic of solid matter; they are strongly influenced by gravity and seldom coalesce or condense. The chemical behavior of particulates can be determined by either the composition of the individual particles or by the types of gases that can adsorb on the surfaces of the particles. In some cases, the combination of particles and adsorbed gases produces a synergistic chemical effect more powerful than that of the individual components. Particulates are usually characterized as primary or secondary. Primary particulates are those produced as a direct result of the chemical or physical processes peculiar to any emission source. Secondary particulates, on the other hand, are those that are produced as a result of chemical reactions that occur in the atmosphere. The following discussion summarizes the major features of both primary and secondary particulates including size distributions, chemical composition and mechanisms of formation. It also outlines briefly the impact that these species can have on our health and esthetics.

OBJECTIVE:

This objective for this project is to develop and design concepts for the next generation of air purifiers based on a user- centered approach.the Solution aims to meet the stakeholder demands be socially.economically and environmentally sustainable.the aim is also to design air purifiers that are attractive for users and that improve the air quality and human health is polluted cities.This project will provide raymond industrial.Ltd a Study in how an air purifier can be designed to be more environmentally sustainable as wall as further study and exploration in how an air purifier interacts with the user and its surrounding environment.that is peoplesproject one or two conceptual air purifiers, all previous ideas and relevents documentation of the development work is delivered to raymond Industrial Ltd.and to Galgotias University.

PROBLEM:

Here the problem is humans can't rely completely over to the plants as these days the pollution created every day is way post the threshold level of purification of air by the plants. So humans need an alternate method to deal with the pollution which is efficient and very natural in its functions.

Technology present today are just focusing on the massive outlets of pollution from industries and other major sources also these days You might be aware that some electronics companies are marketing their air purifiers for be5er air inside your specified room or home. But that Doesn't completely remove the problem as pollution from automobiles also has its significant effect on the levels of pollution.

So there must be a technology that will keep you and your family safe at all the corners of the earth.so there must be an engineered solution for the problem which cleans the nature in nature's way.

1.CO

$2CO+2NO \rightarrow 2CO_2 N_2$ [4]

$NO_2 +CO \rightarrow NO+CO_2$ [5]

$2CO+SO_2 \rightarrow 2CO_2 +S$[6]

2.NO

$2NO_2 +H_2O$ (Cold) $\rightarrow HNO_3 +HNO_2$ [7]

$NO_2 +SO_2 +H_2O \rightarrow H_2SO_4 +NO$[8]

$NO+NO_2 \rightarrow N_2O_3$ [9]

$N_2O_2 +2H_2SO_4 \rightarrow 2NOHSO_4 +H_2O$[10]

$2NO+O_2 \rightarrow 2NO_2$ [11]

$2HNO_3 +NO \rightarrow H_2O+3NO_2$ [12]

$3HNO_2 \rightarrow HNO_3 2NO+H_2O$[13]

$2HNO_3 \rightarrow H_2O+2NO_2 +O$[14]

3.SO :-

$2SO_2 +O_2 \rightarrow 2SO_4$ [15]

$2SO_3 +2H_2O \rightarrow 2H_2SO_4$ [16]$SO_2 +H_2O \rightarrow H_2O \rightarrow H_2SO_3$ [17]

$SO_2 +2NO+H_2O \rightarrow H_2SO_4 +N_2O$[18]

$SO_2 +2HNO_2 \rightarrow H_2SO_4 +2NO$[19]

$SO_2 + 2HNO_3 \rightarrow H_2SO_4 + 2NO_2$ [20]

$H_2SO_3 + H_2O \rightarrow H_2SO_4 + H_2$ [21]

$S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$ [22]

4. CO:-

$5CO_2 + 5H_2O \rightarrow 5H_2CO_3$ [23]

MODEL:

This model is devised to reduce the air pollution at our midst.Its primary aim is to reduce the current most hazardous pollutants from the surround.i.e **SOx.NOX.CO**.P.M.S The whole system is practically natural:there in no use of any type of synthetically generated materials which tend to help the system.the moto to make this system is to purify the nature in natures way .the system uses distillled water and through this way the machine reduce the pollution form our surroundings and no other factories are to be established to make our resource to clean our environment.

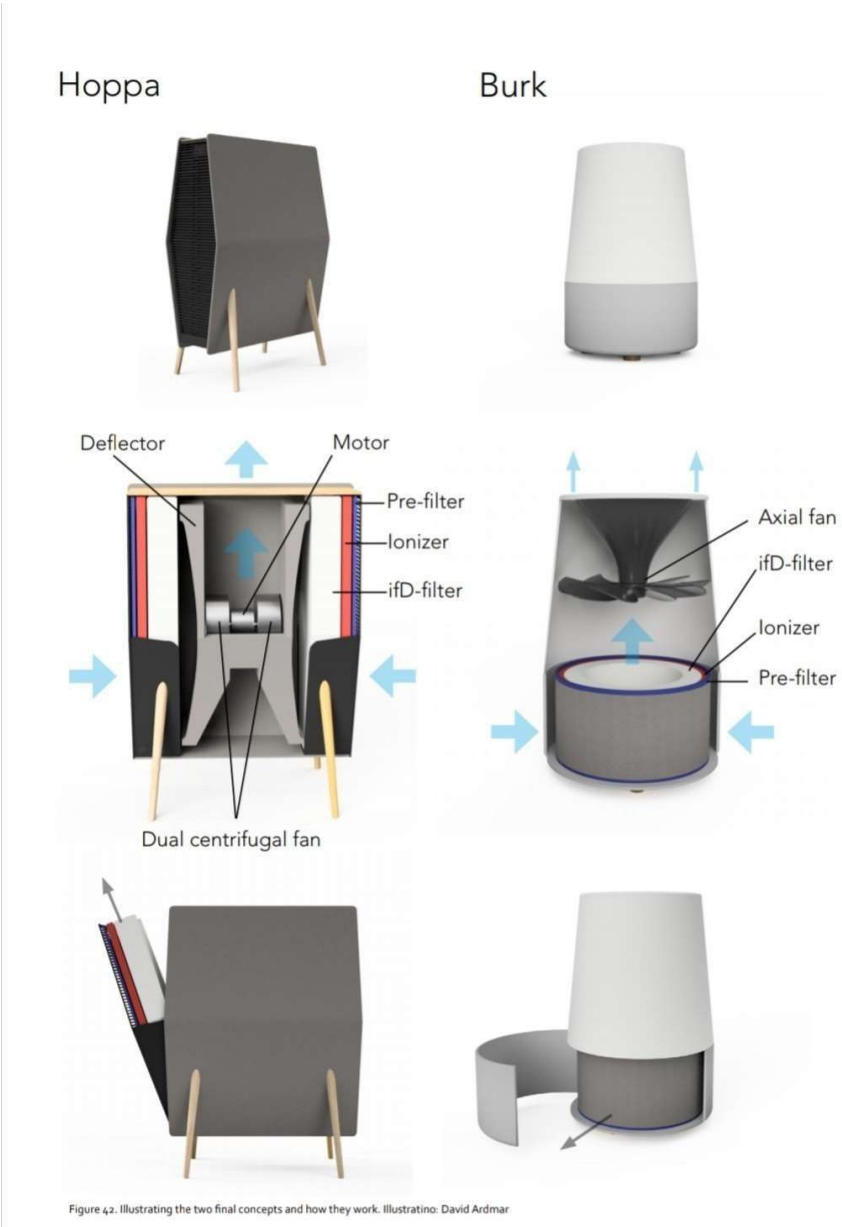


Fig.4.1


ACTIVATED CARBON
MAIN FILTER
PRE- FILTER
IONIZER
Figure 47. Illustrating each part of the filtration system.
Illustration: Johan Bodin

Fig.4.2

Fig.4.3

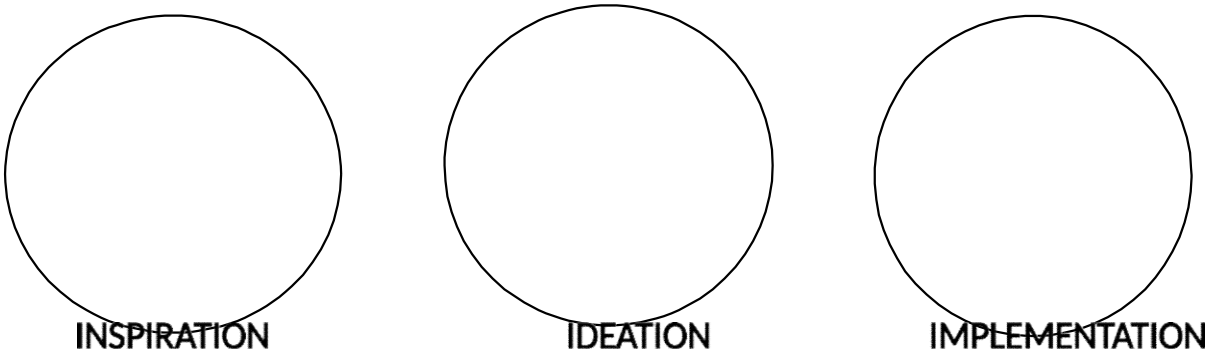
The complete device is kept under the ground to maintain the temperature. this have been a project where both the functionality and the as the tic design have been in equal focus. An air purifier is a product that should be close to the user as much as possible. the design is therefore important but the design relies much on the functionality and how it is designed internally. To work with a process where the design must co-work with the functionality and vice versa have been a challenge. It was the most difficult in the ideation stage. Is it best to keep design and function separate until the concept stage. or is it be5er to tackle both design and function together.

Implementation:-

This project has been conducted with a human centered design approach. Since this is project that aims to develop a product that is going to be used daily by humans. It is important to choose an approach where the human need are in focus. the human centered approach does also consider all relevants take holders that area effected by the design choices made in the process. the project took place in china on one of Raymond Industrials manufacturing facilities, this facilited iteration during the project since stakeholders such as manufacturers was located in the same building. the fact that the project took place in china where air purifiers are used daily was also valuable since it become easier to get in touch with users and sellers.

According to norman(2018) there are for different stage that should take place in a human centered design process. they are observation, ideation prototyping and testing. these stages should according to norman be iterated thoroughly until a satisfying result has been produced. the design company IDEO has developed a similar process but it only contains three stages. In their approach prototyping should occur fluidly in all stages of the process (IDEO.2018).both norman(2015)and IDEO(2018)stresses the people we are design in for is crucial when creating new solutions.

The first stage in the IDEO process is called inspiration. this is where the necessary information is gathered by learning and observation to pursuit the goals of the project. the second stage called ideation is where you make sense of everything learned in the previous stage and create design opportunities by generating and evaluating tons of ideas. the last stage is called implementation. In this stage, you bring your concepts from the previous phase to life and refine your solutions until they are ready for the world (IDEO-2018).the process by IDEO(2019)will be used in this project.



Planning:- The first week of the project was dedicated to planning the project planning started with a discussion about what the purpose of the project was and resources, and also what objectives and aims the project were to have. When planning a project.it is a good idea to get a few things straight first IDEO(2018)

Mentions several things to consider for a successful design project such as timeline, the space for the intended work, the budget for the project. skills needed trips that needs to be take and what will be produced During this first stage there is more room to think through all the logistics of the project. Even though a design project is always changing and evolving as the project goes on there is abe5erchanceforsuccess if a proper plan is laid out in the beginning.

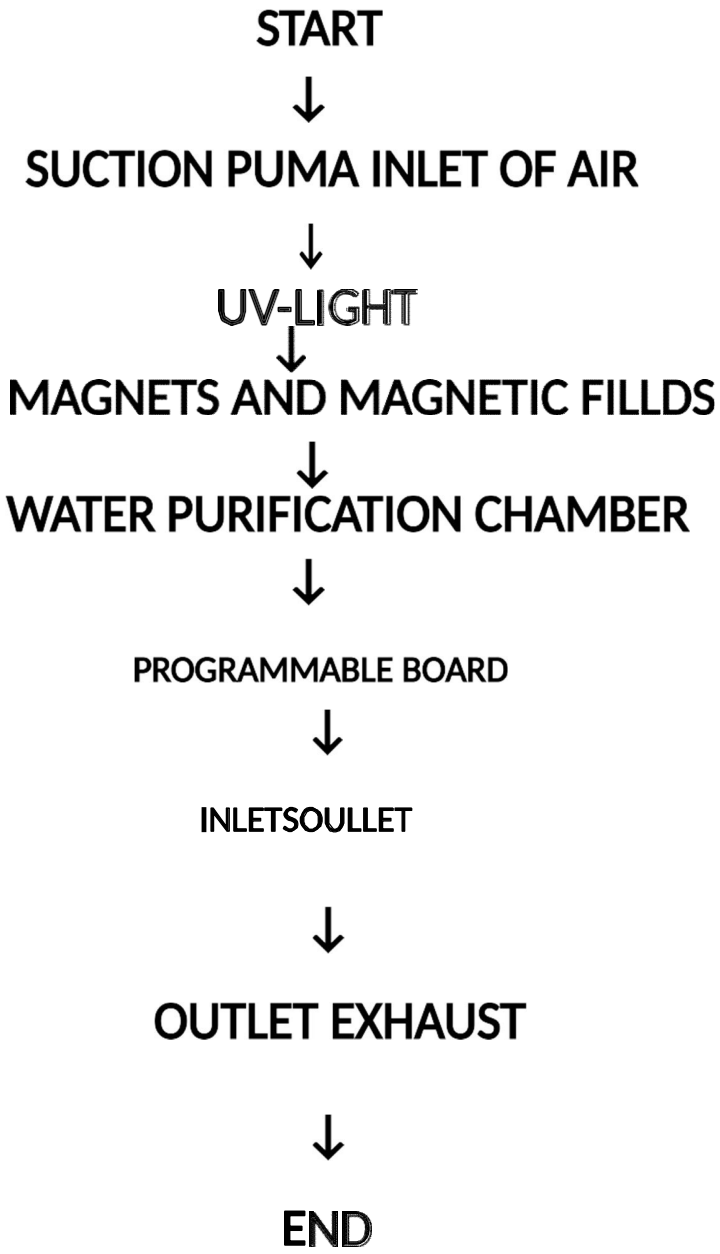
Inspiration:-The chapter explains the methods and how they were used to gather information about the air purifier market and information about the stakeholders that are involved the aim in this stage is to specify needs and requirements.

IDEATION:-This project describe the methods used to explore and generate ideas the methods were selected to facilitate creative thinking to generate ideas both for function and design.

WORKING:

An air purifier is usually equipped with a fan that absorbs air and lets the air pass through a filter media where particles get stuck usually there is a pre-filter that captures larger particles. Behind the pre filter some air cleaning technology, usually a finer filter captures smaller sized particles figures.

The mechanism of air purification may be described with the below flow chart point.



The whole system is divided into 4 segments viz. suction of pollution, UV region, magnetic field and purification chamber. the working of different sections is described as follows.

Suction of Pollution: the suction of the pollution is to be done through a suction pump allowing our system to get a suffcient amount of suction head to clean the polluted air. This system will be mounted over street lights and traffic pump there is need to all at area for the system on the surface of earth.

UV REGION: the UV region in is for the 2 factions of the polluted air and that are SO_{2s} and CO_3, these two are the factions of the polluted air that clont dissolve in the distilled water directly .which is used in the purification chamber in the presence of UV rays and P.M.S the sucked in SO_{2s}in presence of O_2 convert intoSO_{3s}. which are dissolvable in the distilled water used in purification chamber. As for the Cos .they burn in oxygen to form carbondioxide. So by the help of the UV region solution makes two oxides which are dissolvable in distilled water and give us useful acids.

Magnetic Region: It's the main motive is to halt the movement of NO_X. From entering the distilled water simultaneously with the SO_X as by the virtue of SO_x being more reactive. In nature will remove the NO_x from the reactions in side the purification chamber and the NO_x will come out from the whole establishment without being purified. The magnetic field works on the NO_x because their paramagnetic nature. The magnetic region is made up of a crass magnetic field which make the movement of paramagnetic materials in a zigzag path marking then cover more distance than in subordinated diamagnetic materials . SO_x and P.M.S and CO_{2x}having no effect from the magnetic field goes past the magnetic region without any deflection whereas the NO_x gets halts for some moment in the region.

Purification Chamber: In the purification chamber all the components of thepolluted air Comes and get dissolved in the distilled water. For PMs as by the fact they are heavy in nature they settle down in the distilled water present is the chamber due to the weigh. Sox make their respective acids.CO_2 dose same for it and her some time the NO_x which were halted in the magnetic region make their path inside the chamber and make. their respective acids.

Harris Profile: Harris profile is a tool to facilited evaluation and elimination of concepts and ides. Its purpose is to help the designer to reflect in a structured way without marking it two complication. many evalution matrix tools are when complex. time consuming and provides a result that can be hand to poutone's trust on due to the vagueness and uncertain of the design information.

RESULT AND CONCLUSION

The final reaction (summing up all the above reactions) is$5CO+4NO_2+4NO+2O_2+9H_2O\rightarrow$

$5H_2CO_3+N_2O+HNO_3+HNO_3+NO_2+N_2+2NOHSO_4+2H.$

Here it can be observed that the bi-products in the above reaction are all eco- friendly. The acids can be used up for other purposes.

Using the suction pump of 3c.f .m with consumption 150wa5(approx).and magnets of10^{-3}to10^{-5}T.with the UVC lamp of consumption of 36 wa5,5 billion Ls of air can be purified by a single liter of water but the condition is that the air is stagnant so by this method the machine can clean whole delhi by approx 3 months by using our single machine.

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Equipment for Air Pollution Control

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Abstract:
Decreasing the pollution of level is now the main aim for many. Pollution is in many forms; almost every natural thing is now affected by the term pollution. Not only land, Water, air, but each and every thing belongs to the planet is now in danger levels of pollution. Already human civilizations woke up to reduce this danger but are not into many things one of such is air. Air pollution is one of the hardest challenges to the human sas it is beyond our hand limits. So there must be a technology for that to decrease the alarming levels of air pollution back to the bottom. In this method the air is being purified by the use of distilled water only, without the use of any synthetic material and/or chemical substance. Here, the air is made passed through the water so by reaction with water, Pollutants stay in it results in clean air. In this method air is being is purified by pollung water, but the fact is cleaning water is easy thing. There are many methods for this but cleaning air needs some boost up in the technology level.

I. INTRODUCTION

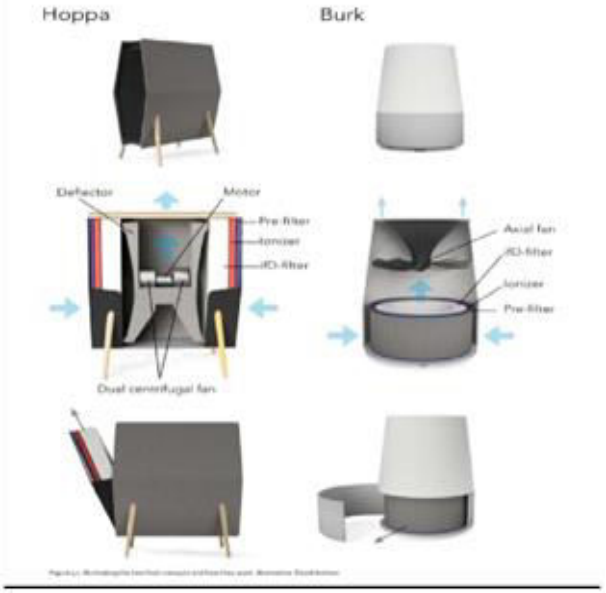
Pollution is one of the biggest disasters which world is facing right now. Population and the respective technology in current scenario are only making our surrounding even worse. Researchers and engineers are on their full scale to bring the danger level down but are still not at their desired point. Some facts say by global warming (a main indicator of pollution) some of the countries like Miami of South-Florida, Texas will be completely submerged under water by the end century i.e. the ice melting in such a faster way that the sea level increasing rapidly. This is just an example which explains that pollution is such a monster that will eventually end life on Earth. A lot of dangerous diseases are caused due to it and is leading to the deaths of many. Many countries and larger cities in the world are struggling with severe air pollution today. Factories, Vehicles and use of non-renewable energy pollutes the air around the cities of India. This is major problem, the polluted cities in these countries are home to more than 1 billion citizens. The solution that people use to clean the indoor air in the polluted areas are called air purifiers. It is a device that the most people are affected by poor air quality keep in their homes and offices. The air purifiers function is usually to create an airflow in the home by suction fan inside the device. The air then passes through some sort of filter media which traps the polluted particles, and out comes clean air. However most air purifiers in the market today are using a so called HEPA filter, which need are – placement every few months and consume a lot of energy. This solution is rather costly and is not suitable for every one since one of the most important factors to customers when buying an air purifiers is the price. An air purifier is also a part of the furnishings in a home which also makes the aesthetic design of the air purifier important.

II. OBJECTIVE

The objective of this project is to b develop and design concepts for the next generation of air purifiers based on a user - centred approach. The solution aims to meet the stakeholder demands be socially, economically and environmentally sustainable. The aim also to design air purifiers that are attractive for users and that improve the air quality and human health of polluted cities. This project will provide Raymond industrial. Ltd. A study in how an air purifier can be designed to be more environmentally sustainable as well as further study and exploration in how an air purifier interacts with the user and its surrounding environment. i.e. peoples, homes and offices. At the end of the project one or two conceptual air purifiers, all previous ideas and relevant documentation of the development work is delivered to Raymond Industrial Ltd. and to Galgotias University.

III. MODEL

This model is devised to reduce the air pollution at our midst. Its primary aim is to reduce the current most hazardous pollutants from the surround. i.e. **SOX.NOX.CO**. P.M.S. The whole system is practically natural: there is no use of any type of synthetically generated materials which tend to help the system is to purify the nature's way. The system uses distilled water and through this way the machine reduce the pollution form. Our surroundings and no other factories are to be established to make our resource to clean our environment.



IV. RESULT AND CALCULATION

The final reaction (Summing up all the above reactions) is

$5CO+4NO+4NO+2O_2+9H_2O\rightarrow$
$5H_2CO_3+N_2O+HNO_3+NO_2+N_2+2NOHO_4+2H.$

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V. REFERENCES

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