VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JnanaSangama, Belagavi – 590018

A Project Report
On

"LEAP - Solar (Air Purifier)"

Submitted in partial fulfillment of the requirements as a part of the curriculum,

Bachelors of Engineering in Mechanical Engineering

Submitted by

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2019-20

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CERTIFICATE

Certified that the project work entitled "**LEAP Solar (Air Purifier)**" is a bonafide work carried out by **Mr. Frederic Sharon, Ms. Gomathi V, Mr. Prajwal S, Mr. Sagar P Reddy,** bonafide students of **CMR Institute of Technology** in partial fulfillment for of the requirements as a part of the curriculum, **Bachelors of Engineering in Mechanical Engineering,** of **Visvesvaraya Technological University, Belagavi** during the year **2019-20**. It is certified that all correction/suggestion indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of the project work prescribed for the bachelor of engineering degree.

(Vinay M N)	**(Dr. Vijayanand Kaup)**	**(Dr. Sanjay Jain)**
Signature of the Guide	**Signature of the HOD**	**Signature of the Principal**

External Viva

Name of the Examiners	**Signature with date**
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2.	

DECLARATION

We, students of Eighth Semester, B.E, Mechanical Engineering, CMR Institute of Technology, declare that the project work titled **"LEAP Solar (Air Purifier)"** has been carried out by us and submitted in partial fulfillment of the course requirements for the award of degree in **Bachelor of Engineering in Mechanical Engineering** of **Visvesvaraya Technological University, Belagavi,** during the academic year 2019-2020.

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Place: Bengaluru

Date:

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DEPARTMENT OF MECHANICAL ENGINEERING

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BANGALORE – 560037

ABSTRACT

This project is about designing and fabricating an air purifier system which is powered by solar energy and testing the effectiveness of the system to curb the air pollution. The focus is on extracting the suspended particulate matter from the air which are the major contributors in the pollution of air in many urban cities.

Air purifiers may also be used in industry to remove impurities such as CO_2 from air before processing. Pressure swing absorber or other adsorption techniques are typically used for this. Air filtration is frequently recommended as a component of environmental control measures for patients with allergic respiratory disease. Residential air filtration can be provided by whole house filtration via the home's heating, ventilation, or air conditioning system, by portable room air cleaners, or a combination of the two.

In this project we determine the mass concentration and pulse ratio of air particles in different environment using PPD71 sensor and we develop the air purifier using bio-degradable materials to avoid clogging and the contaminants entering air filter. We are using solar cells for the power supply required to run the air purifier.

ACKNOWLEDGEMENT

We take the opportunity to express a deep sense of gratitude towards our guide **Mr. VINAY M N** Asst professor, Department of Mechanical engineering, CMRIT, Bangalore for providing excellent guidance, encouragement and inspiration throughout the project work. We consider ourselves extremely lucky to be able to work under the guidance of such dynamic personalities.

We would like to express our sincere gratitude **to Mr. VIJAYANAND KAUP**, HOD, Dept of Mechanical engineering, CMRIT whose inspiration, guidance and support helped us to complete the project work satisfactorily.

We would like to thank our beloved principal **Dr. SANJAY JAIN**, for extending a kind co-operation during our academic endeavors.

Above all, we would like to express our thanks to all the teaching and non teaching staff who directly or indirectly helped us to complete the project successfully

Lastly, we thank our family and friends for their constant support and encouragement.

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CHAPTER 1

INTRODUCTION

Pure air is a mixture of several gases that are invisible and odorless. It consists of about 78% nitrogen, 21% oxygen, and less than 1% of argon, carbon dioxide, and other gases — as well as varying amounts of water vapour.when air gets contaminated by various harmful gases and particulate matter, it causes air pollution.

Indoor air quality (**IAQ**) is the air quality within and around buildings and structures. IAQ is known to affect the health, comfort and well-being of building occupants. An **air quality index** (**AQI**) is used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. Public health risks increase as the AQI rises. Different countries have their own air quality indices, corresponding to different national air quality standards. Some of these are the Air Quality Health Index (Canada), the Air Pollution Index (Malaysia), and the Pollutant Standards Index.

1.1.PARTICULATE MATTER

Particulate matter pollution or particulate pollution is one of the deadliest types of air pollution in India and on a global level. The primary reason for the rise in particulate pollution, type of air pollution, is because of human activities. Major sources of particulate matter emission are factories, power stations, incinerators, industries, automobiles, and diesel generators. Suspension of microscopic solids and liquids particles present in the form of droplets floating in the air or atmosphere refers to as Particulate pollution. Particulate pollution/ particulate matter/ Atmospheric particulate matter is called PM. The source of the particle can either be natural or anthropogenic.

Particulate matter on the basis of size can fall into two different categories:

- **Inhalable coarse particles:** The diameter size of the particles range from 2.5 to 10 micrometers (PM10 – 2.5).

- **Fine Particles:** Usually found in haze and smoke and the size can range up to 2.5 micrometers (PM).

Smoke Particles

Smoke particulates contain a mixture of liquid and solid particles. Combustion of any kind of organic matter leads to the formation of smoke particles. Examples include the release of smoke from a cigarette, burning of garbage and dry leaves, burning of fossil fuel, oil, etc.

Dust

The size of dust particulates is more than 1 micrometer (μm) in diameter. Dust particulate matter originates from grinding, crushing, and attribution of solid substances. Examples of this type of particulate emission include the release of sawdust during word works, release of sand particles during sandblasting, pulverization of coal, release of fly ash and cement from factories, dust storms, etc

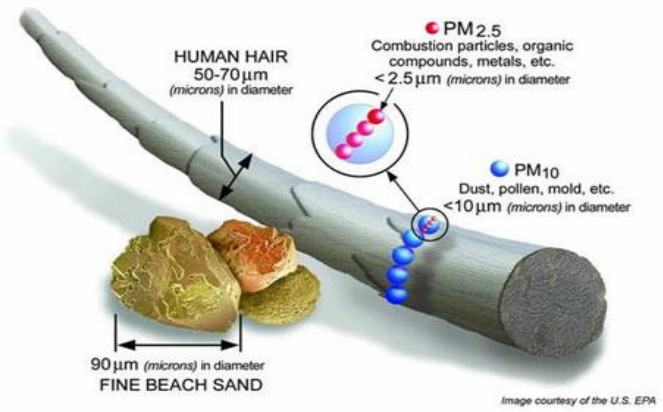


Fig. 1.1 Particulate Size

Mists

Vapors in air undergo condensation to form a mist. Production of mist is also possible by particles of spray liquids. For instance , herbicides and pesticides are used in the form of sprays in agriculture but sometimes it is possible to miss the spray target and enter the atmosphere and form mist. Another example is the sulfuric acid mist.

Fumes

Formation of fumes is possible by the condensation of vapors during different processes such as boiling, distillation, sublimation, and other types of chemical reactions. Organic solvents, metallic oxides, and metals undergo a chemical reaction to generate fume particles.

1.2. SOURCE OF PARTICULATE MATTER

Traffic is a source category that includes different kinds of emissions from various vehicle types. In addition to primary PM emissions from exhaust, and the emissions of organic and inorganic gaseous PM precursors from the combustion of fuels and lubricants, vehicles emit significant amounts of particles through the wear of brake linings, clutch, and tires. These are deposited onto the road and then re-suspended by vehicle traffic together with crustal/mineral dust particles and road wear material.

Industry is a heterogeneous category including mainly emissions from oil combustion, coal burning in power plants and emissions from different types of industries (petrochemical, metallurgic, ceramic, pharmaceutical, IT hardware, etc.) and from harbor-related activities. Industrial sources are sometimes mixed with unidentified combustion sources or traffic.

Domestic fuel burning includes wood, coal and gas fuel for cooking or heating. A typical case of household air pollution coal burning for domestic heating is found in Central Europe where wood and coal are used for domestic heating.

Natural sources including soil dust and sea salt Dust is characterized by elements abundant in the earth's crust rocks and the soil. These components of PM are associated with the re-suspension from fields or bare soils by local winds.

1.3. EFFECTS OF PARTICULATE MATTER

1.3.1 Effects on Health

Failed Pregnancy Particles ability to enter into the body makes it easy to enter any pregnant mothers body and then into the Lung Cancer.PM vary in shape and size. Fine particulates can enter easily and penetrate deep into the respiratory systems of human and can affect the lungs. It attacks the bronchi and can cause lung cancer.

Asthma Reports suggest that particulate pollutants can cause asthma with the increase in the fine pollutant globally. Rising rate of diagnoses links asthma to particulate matter pollution.

Cardiovascular Problems Fine particles can easily enter the body without facing resistance from the body. Therefore fine particles have a drastic impact on the heart and the functions of the heart. Therefore,

particulate matter is responsible for many cardiovascular diseases. Frequent exposure to PM can lead to a large amount of inhalation of particles. Therefore, accumulation of PM will cause the buildup of plaque in the arteries and vascular inflammation.

Atherosclerosis Air pollutant inhalation can cause plaque buildup. This will lead to hardening of arteries and in turn cause heart problems. Birth Defects and Child during long exposure to particulate air pollutants. Thus, the harmful chemical pollutants can cause any type of birth defects. It is also the reason failed pregnancies specifically in town and cities facing extreme levels of pollution.

Death High levels of aerosols and other pollutants can cause premature death. Air pollution due to coal industries is the cause of many premature deaths every year in India and globally.

Effect on Vegetation and Plants Particulate pollutants have the ability to block stomatal openings. Therefore, it can retard the photosynthesis process. Hence, air pollutants can damage the plant, reduce crop and vegetation yield, and increase their mortality rate.

1.3.2 Effect on Climate

The rise of particulate pollution is disturbing the environmental balance. Therefore, it is predicted that it can be the precursor of many climatic disasters such as volcanic eruptions. Reports suggest particulates matter can negatively impact weather on a regional level. PM decreases the levels of evaporation of water in the Indian Ocean. It is linked to the lack of Indian Monsoon or reduction of the Indian Monsoon.

1.4. MOTIVATION

As we know that air pollution level in cities is very high. Most of the pollution comes as by-product from vehicle and construction of buildings,these are in form of particulate matter which are like methane,carbon dioxide,dust particulate etc.These create a lot of health problems like respiratory illness,decreased lung functions,development of diseases like asthma etc.

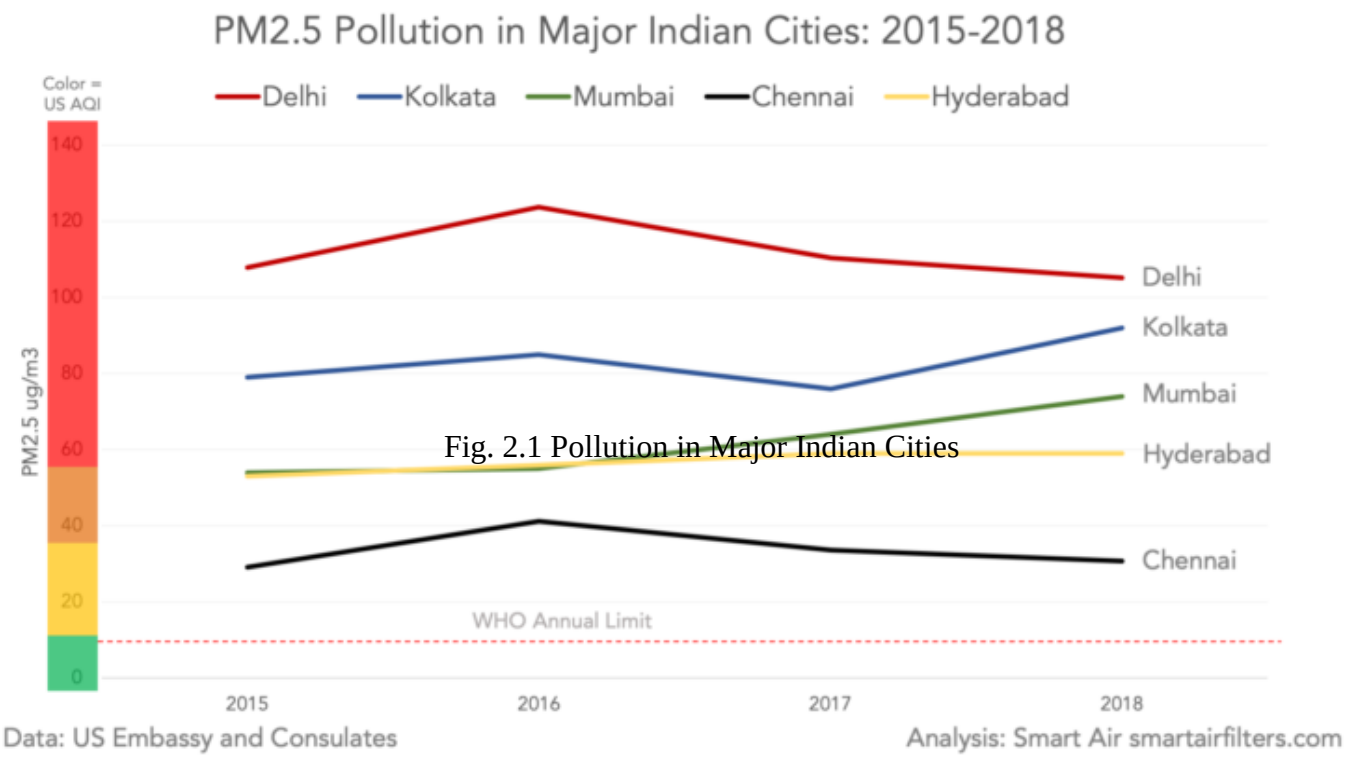


Fig. 2.1 Pollution in Major Indian Cities

Although there are many types of air purifier that are available in market but none of them are sufficient enough to deliver its working efficiency in public places like bus stand, near hospitals, traffic signals etc.Many peoples are not able to afford these because of high cost and installation cost. Government organizations have very low budget for air purifier like extra extra expenditure .So, it is advisable to develop such air purifier which can cost less and are highly efficient.

So we are aiming at making solar powered purifier, which runs on solar energy with bio-degradable filters. Our motive is to develop low cost and highly efficient air purifier.

CHAPTER 2

LITERATURE REVIEW

Airborne particulate matter is a diverse pollutant class whose excessive presence in indoor air contributes to an array of adverse health and material-damage effects. Particles are classified according to their diameter into three size modes: Ultra-fine (0.1 micron), accumulation (0.1-2 micron), and coarse (= 2 micron). These modes have largely distinct sources and composition, and they exhibit different dynamic behaviors.[1].Thus Air filtration plays an important factor in improving air quality and hygiene at work. The demands on air quality and hygiene at workplaces have increased greatly due to new regulations, new scientific knowledge and a change in health consciousness. Apart from temperature and relative humidity, primarily the concentration of gaseous and solid contaminants is an important parameter to evaluate the air at workplaces.

Various theories of air filter technology was performed to minimize the health effects due to airborne particulate matter such as classic filtration theory,electrostatic capture mechanism, etc.Fine particle movement was first observed by botanist Brown in the early 19th century when fine particulates suspending in the liquid, which was defined as Brownian motion (Thomas, Penicot, Contal, Leclerc, & Vendel, 2001).

Conventional filtering materials' filtration mechanism is the result of various kinds of synthesized effects, such as the inertial effect, the diffusion effect, the interception effect, the electrostatic effect, gravity, the thermophoresis effect and the Van der Waals force, etc., of which the first three are the predominantly govern filtration mechanisms.

The major parameters of filter materials are fibre diameter, filter thickness, packing density, fibre charge density and face velocity.The study found that fibre charge density and face velocity are more significant for filtration efficiency than other factors, and that filtering efficiency increases with increasing fibre charge density and with decreasing face velocity. Moreover, decreasing fibre charge density, filter thickness and packing density, increases aerosol penetration through the electric filter media.In contrast, aerosol penetration is in direct proportion to fibre diameter and face velocity.Glass fibre air filter material appeared in the United States and obtained US patent in 1940. Since then, it developed rapidly. By the

1970s, the HEPA (high efficiency particle air filter) with super fine glass fibre paper could achieve 99.9998% efficiency for ≧0.3 μm dust.

Mechanical types of filters are, in general, effective for the removal of coarser particulate matter; these can be used to reduce the burden of the filter unit. For collecting small particulate matter, electrostatic precipitator, wet scrubber and fabric filters are the only options. Among all the filters, the most efficient and the versatile is the fabric collector, especially when processing very fine particles, which are very slow to settle.

The overall collection efficiency of the existing devices is high for fabric filters, followed by electrostatic precipitator, wet scrubber. In selecting air pollution control equipment, both technical and economical considerations should be made. The selection should primarily concentrate on technical merits. As the technical selection is over, it is essential that economic factors, capital and operating costs, should play an important role.

To know the air particles weight ratio around us PPD71 particulate matter sensor is used to sense the number of particles at inlet and outlet. It detects airborne particles continuously, then outputs the detection results in UART digital output based on mass concentration. It is sensitive to dust, particles and cigarette smoke which can trigger many allergic symptoms.

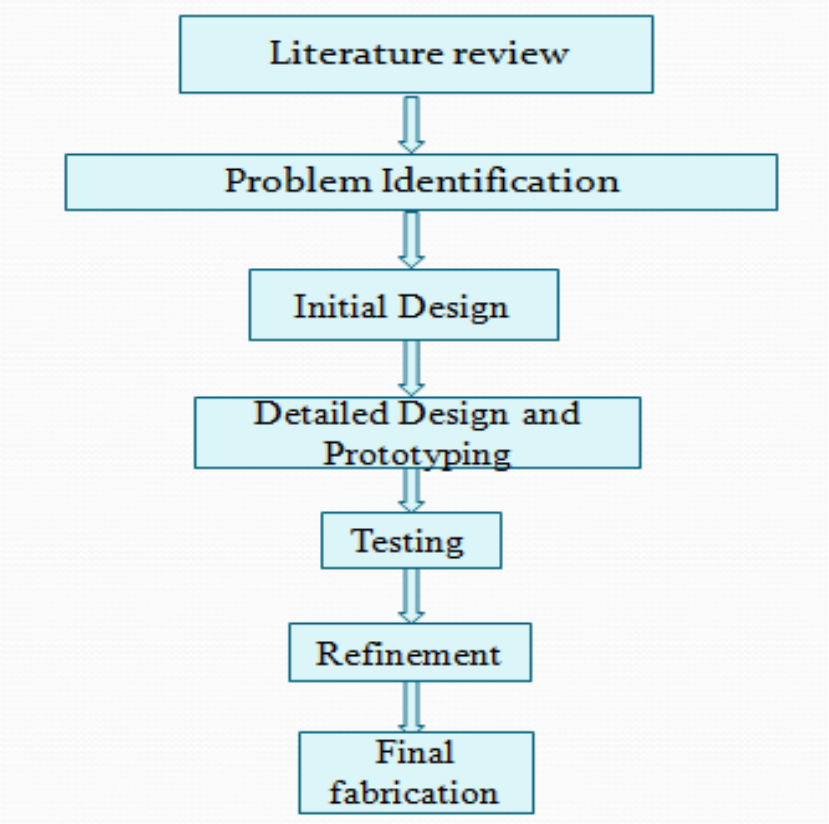
CHAPTER 3

OBJECTIVES AND METHODOLOGY

3.1 OBJECTIVE

- Development of bio-degradable filter material.
- Development of fabric air filter which can capture minute dust particles.
- Optimum use of solar panels.
- Determination of mass concentration at the inlet and outlet.
- Integration of PPD_{71} sensor to detect airborne particles continuously.
- Comparing values of input and output air at a particular locality.
- Fabrication of LEAP-air purifier.

3.2 METHODOLOGY



CHAPTER 4

AIR FILTER MATERIAL

4.1 DIFFERENT TYPES OF AIR FILTER MATERIALS

1.Fiber glass

Spun fiberglass is an affordable and reliable resource for filtering air and trapping contaminants. Fiberglass is excellent for trapping large contaminants, such as dust and pet dander, and it often helps maintain superior air flow. Many HEPA filters are made primarily from fiberglass. Although fiberglass can be effective, its biggest advantage is often pricing. Compared to other filters, fiberglass filters can be more affordable, making air purification less expensive over the long term. On the negative, glass fiber filters require more filter media than a HEPA filter that is made of synthetic material. In having more filter media, the air flow resistance, also known as pressure drop, is higher. This means the airflow through the glass fiber filter will be a little less.

Fig. 5.1 Fiber Glass

2. Activated carbon

Activated carbon, which is made from charcoal, is one of the most effective cleaning materials on the planet, and it's been used for centuries to clean water, air, and even our bodies. Carbon is highly porous, but it needs to be treated with heat, chemicals, and other measures to remove various elements. When treated, or "activated," the result is a highly porous material that can remove many of the tiniest particles; particles that are too small to be captured even by HEPA filters. Activated carbon is considered

one of the safest, most reliable air filter materials available today. Although it can be more costly, largely because of the activation process, it is incredibly reliable, consistent, and effective. In fact, it's not just used for air and water purification, it's also used for decaffeinating beverages and even purifying gold.

3. Plastics

Plastics, most often polypropylene, are durable and reliable materials that can be used to make filters, which are often washable. This creates both long-term affordability, as you don't have to purchase new filters, as well as an eco-friendly product,as new resources are not required. Plastic filters, often called synthetic filters, can be effective resources for removing impurities for the air, creating a cleaner indoor space. In EJ120 and Erik650A air filters, we add a charge to the synthetic filter fibers to give the filters a boost in performance. This gives the advantage of higher filter efficiency without an increase in the pressure drop or any impact to the air flow or noise level.

4. Plants: Nature's Air Filter

If we define filters as a material that allows air to pass through while capturing contaminants, then plants are most certainly a type of air filter. Plants absorb air through tiny pores, which are usually located on their leaves. These pores take in air and use the CO2 during photosynthesis, converting light into their food. However, while they take in CO2, they are also taking in other gases, toxins, VOCs, and other microscopic contaminants. When used as a supplement to your purification system, a plant's air filtering ability can add healthier air and more oxygen to your indoor environment. While plants can clean the air of indoor air pollution related to gases, the effect is limited and plants provide no help in removing airborne particulates (dust, mold spores, pollen, etc.).

4.2. TYPES OF AIR FILTERS

1. City Pleat

Application: Combination filtration to achieve particle pre-filtration and control of low level gaseous pollutants. Typical applications include IAQ improvement in city centre buildings, shopping malls and other public buildings.

Type: Pleated Panel

Frame: Water resistant cardboard

Media: Synthetic/Activated carbon

Dimensions: Filter front dimensions according EN 15805

Rec. final pressure drop EN 13053: 150 Pa
Maximum airflow: 1,25 x nominal flow
Temperature max: 40ºC
RH. max 70%

Fig.5.2 City Plea

2. Aero Pleat Eco

Application: Pre filter for comfort air conditioning applications
Type: Pleated Panel
Frame: Water resistant cardboard
Media: Cotton/Synthetic
Dimensions: Filter front dimensions according EN 15805
Rec. final pressure drop according EN 13053: 150 Pa
Maximum airflow: 1,25 x nominal flow
Temperature max: 70ºC
RH. max: 100%
Mounting/Frames: Front and side access housings and frames are available.

Fig. 5.3 Aero Pleat Eco

3. Cam Met Metal Filter

Application: Metal filter for grease or oil mist separation. Prefilter for thick particles.
Type: Metal Panel
Frame: Metal
Media: Galvanized steel, Stainless steel, Aluminium
Type: G2 Metal filter and high oil separation efficiency
Frame: Aluminium EN-AW-6060, ALMG3, stainless steel AISI 304L, acid stainless steel AISI 316L, galvanized
Media: Woven metal wire mesh. Can be made in aluminium, galvanized, stainless steel or acid stainless steel material
Grating: Aluminium, Hot-dip galvanized expanded metal net.

Fig.5.4 CAM MET Metal Filter

4. Cam Vane 100

Application: Intake grille which is a very efficient for rain protection.

Fig. 5.5 CAM Vane

It is used in all filter installations where the water, rain and moisture problems occur, such as in marine environments, coastal areas, the rivers and inland.
Type: Metal Panel
Mounting/Frames: Mounting flange or fastening ears to customer specifications.
Type: Cam Vane has specially-shaped aluminum profiles which generate turbulence in the airflow.
Frame: Aluminum EN-AW-5754
Profiles: Aluminum EN-AW-6060
Air velocities: 1.0 - 5. 0 m/s in the duct system
Size: Supplied with any dimensions up to 2500 x 2500 mm
Deep: Standard 100 mm
Drainage: Supplied with drain at the bottom.
Air velocity (m/s): 1,0 - 5,0
Size WxH (mm): Up to 2500 x 2500
Deep D (mm): 100
Air velocity (m/s): 1,0 - 5,0

4.3. THE FUNCTION OF AIR FILTERS

An air filter is usually made of a spun fiberglass material or from pleated paper or cloth enclosed in a cardboard frame. It's basic function is to clean the air that circulates through your heating and cooling system. Filters trap and hold many types of particulates and contaminants that could affect your health and comfort, including:

- Dust and dirt
- Pollen
- Mold and mold spores
- Fibers and lint

- Metal, plaster or wood particles
- Hair and animal fur
- Bacteria and microorganisms

4.4. FILTRATION METHODS

Air filters can be classified into three groups based on their filtration method: mechanical, electrostatic, and electronic.

Mechanical Filtration

Mechanical filters simply capture contaminants on the filter media and can work in three different ways, depending on the size of the particles being filtered:

- **Straining** occurs when contaminant particles are larger than the space between the media fibers, causing them to collect on the filter media. Straining is effective for filtering larger particles such as lint or hair.
- **Interception** occurs when particles, following the air stream, come in contact with media fibers and remain trapped there due to Van der Waal force, which describes the molecular attraction present.
- **Diffusion** is effective when filtering very small particles and is often employed by HEPA and ULPA filters. In diffusion, the particles are so small that they move erratically within the air stream, causing them to become stuck to media fibers.

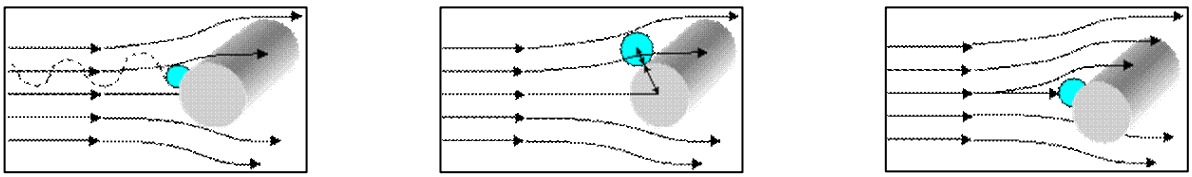


Fig.5.6 Three methods of mechanical filtration (left to right): Straining, Interception and Diffusion.

Electrostatic Filtration

Electrostatic filters use electrostatically charged media fibers which attract and trap airborne particles. These filters typically use polypropylene or polyurethane filter medias. Electrostatic filters are capable of 94-96% efficiency in eliminating contaminants under proper operating conditions.

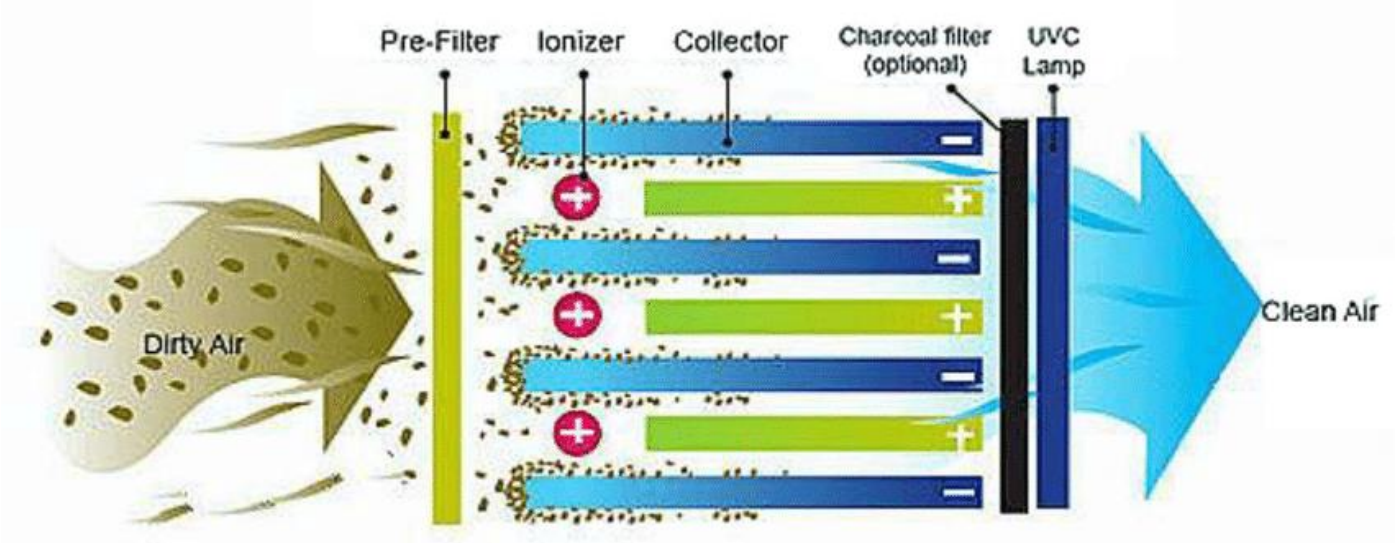


Fig. 5.7 Electrostatic Filtration

Electronic filters consist of a series of electrodes inside the filter grid. When current is applied to the electrodes, particles drawn into the filter will cause a voltaic arc and take on a positive charge. The particles are then attracted to and trapped within a negatively-charged group of electrodes or a disposable/cleanable collector pad. Electronic filters are very effective at filtering small particles but are also noisy, relatively expensive, and difficult to service compared with mechanical or electrostatic types.

4.5. SELECTION OF AIR FILTER MATERIAL

Air filter units should be selected on the basis of the following items:

- level of filtration needed
- filter classification requirements
- cost-effectiveness
- stable collection efficiency

- dust storage capability at a low pressure differential level.

Particular points to be borne in mind during the design of an air filtration system are:

- airflow (should be as uniform as possible across the face of the filter)
- pre-filters should be used ahead of high-efficiency filters to give longer service life
- if the system draws in air from an external wall, then weather louvers and bird screens should be fitted at the intakes
- a differential pressure drop gauge should be fitted across the system to determine when a filter should be serviced
- sufficient access should be provided for servicing the filters
- filters should not be used beyond their specifications
- the recommended final resistance should not be exceeded
- electrostatic air cleaners should not be installed where free moisture can affect them
- the selection of air filters on the basis of lowest cost is not a reliable option in any system design, future needs should be borne in mind and system requirements should be fully discussed with equipment manufacturers.[4]

4.6. SELECTION OF FILTER MATERIAL FOR THIS PROJECT

We have selected cotton with 600 TPI[5],Nylon and paper as a filter material.Cotton is preferred for its performance, strength and versatility.

- Superior Quality – It is usually strong in nature. Cotton hardly breaks or loses its strength. The filter cloths last much longer naturally owing to their strength. It also ensures serving users longer than other common industrial synthetic cloth.

- Hassle Free Cleaning – Cotton filter cloth is used to remove dust and dirt from purifiers. Therefore, there is always a chance of accumulation of dirt as a collective cake on the cloth. However, this amazing cloth allows you to clean it easily to remove the dirt cake off so you can easily reuse the cloth over and again.

- Inexpensive – There are many filter fabrics that are used for the filtration process. They are used for filtering dirt and dust from liquids like water and oil. Among many types of filter cloths available on the market, cotton is often preferred for its cost-effective.

CHAPTER 5

SENSOR SELECTION

5.1. INTRODUCTION TO PPD71 SENSORS

PPD71 also referred to as photo particle detector sensors are the sensors which detects airborne particles continuously, then outputs the detection result in UART digital output based on mass concentration (μg/m^3).PPD71 is sensitive to dust, particles and cigarette smoke which can trigger many allergic symptoms.

●Better accuracy and high linearity from low to high concentration by applying new optical design, a micro-controller, and digital calibration.

●Long operating life time by using custom-made components and manual maintenance.

●No external fan needed because of auto suction by a built-in heater resistor.

●No ripple limitation because of a voltage regulator. （Comparison to the current PPD series）

Multiple outputs from UART: μg/m^3 and pulse information (Pulse occupancy ratio**)** offer individual control algorithm design on customer's side.

5.2. DETECTION PRINCIPLE (PARTICLE COUNTER)

Light source emitted from light emitter narrows down the focus to detection area. When particles inflows into detection area, they generate scattering light which intensity is depended on particle size. The number of pulse count at certain period equivalents to number concentration.

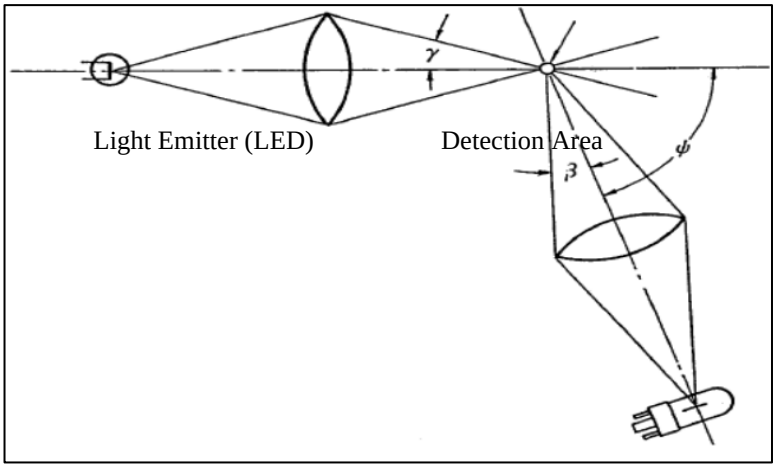


Fig. 6.1 Detection Principle of PPD71

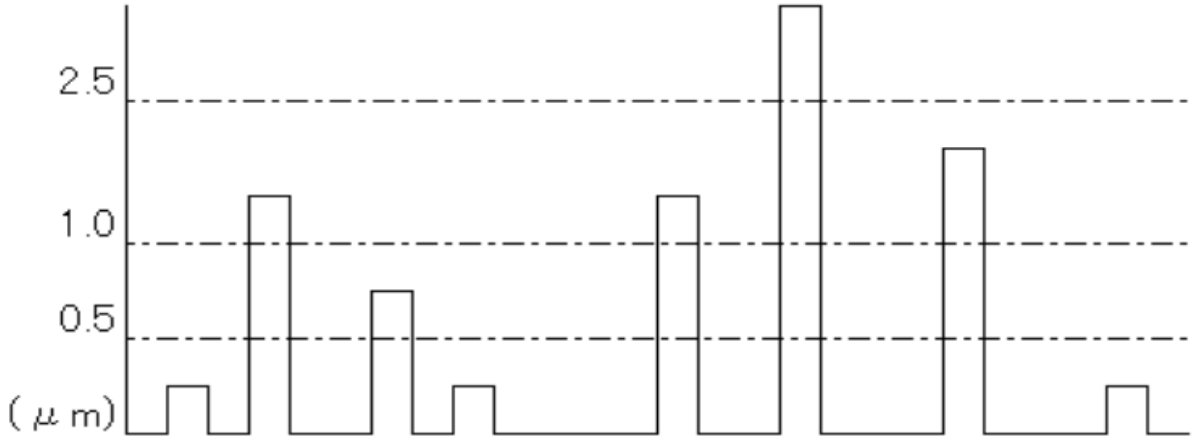


Fig. 6.2 A Plot of Pulse Ratio v/s Time

5.3. PPD71

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- The smallest sensor ever.
- Redesigning sensor structure achieves the smallest Single particle sensor.
- Easy to design your software.
- PM2.5 digital output by UART communication offers you designing software easily.
- Better accuracy.
- New optical design and a built-in MCU provide better accuracy and fine particle sensing.
- Long life, high reliability.
- Using custom-made key optical parts achieves long operating life time with high reliability.

Fig. 6.3 PPD71 Sensor

MODEL NAME	**PPD71**
DIMENSION	30(W) × 30(H) × 28(D) [mm]
DETECTABLE SIZE	Over 0.5μm (approx.)
DETECTION RANGE	0 to 500μg/㎥
LIGHT SOURCE	LED
OUTPUT METHOD	UART
RIPPLE	NO LIMITATION
DETECTION METHOD	Auto-suction by a built-in heater resistor
MAINTAINANCE	Possible
INITIAL STABILIZATION	time 60 seconds after power is supplied
POWER CONSUMPTION	Below 100mA
REFERENCE	TSI DUSTTRACK II 8530
OPERATING TEMP & HUMIDITY	-10 to 60degreees, below 95%rh

Table: Specifications of PPD71 Sensor

CHAPTER 6

DESIGN OF OUTER CASING

Outer casing structure is developed with necessary dimensions and taking portability of air purifier into account. The outer casing consists of three main parts:

1. **Filter Housing**: It is basically a square of 20*20 cm and height 50cm.Lower portion this housing consists of holes of sufficient diameter to allow the flow of air for filtration. Filter will be placed above these holes.

2. **Roof**: It is pyramid shaped structure of dimension 40*40 base and 20cm height which will be mounted on top of filter housing. This is mainly used for uniform distribution of filtered air.

3. **Battery Casing**: It is in cuboid shape of dimension 40*40*12 cm. In this casing, battery required to power the air purifier will be placed. Also other electronic components will be mounted inside battery casing.

6.1 DESIGN IN SOFTWARE

Outer casing was first designed in CATIA V5 design software to get most feasible structure.

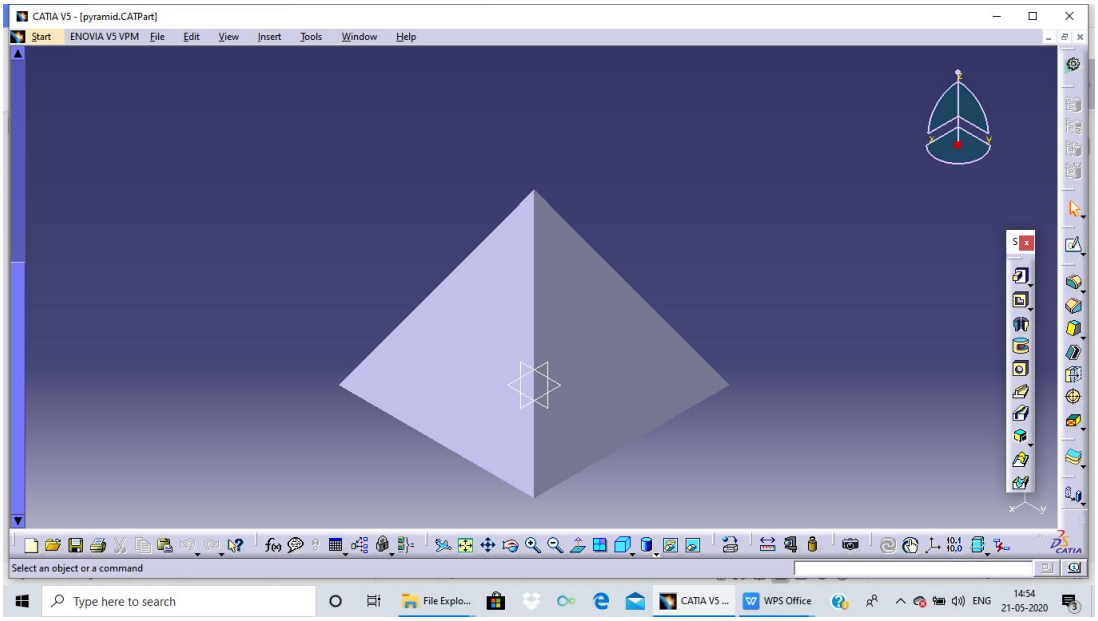

Fig. 7.1 Design of Roof

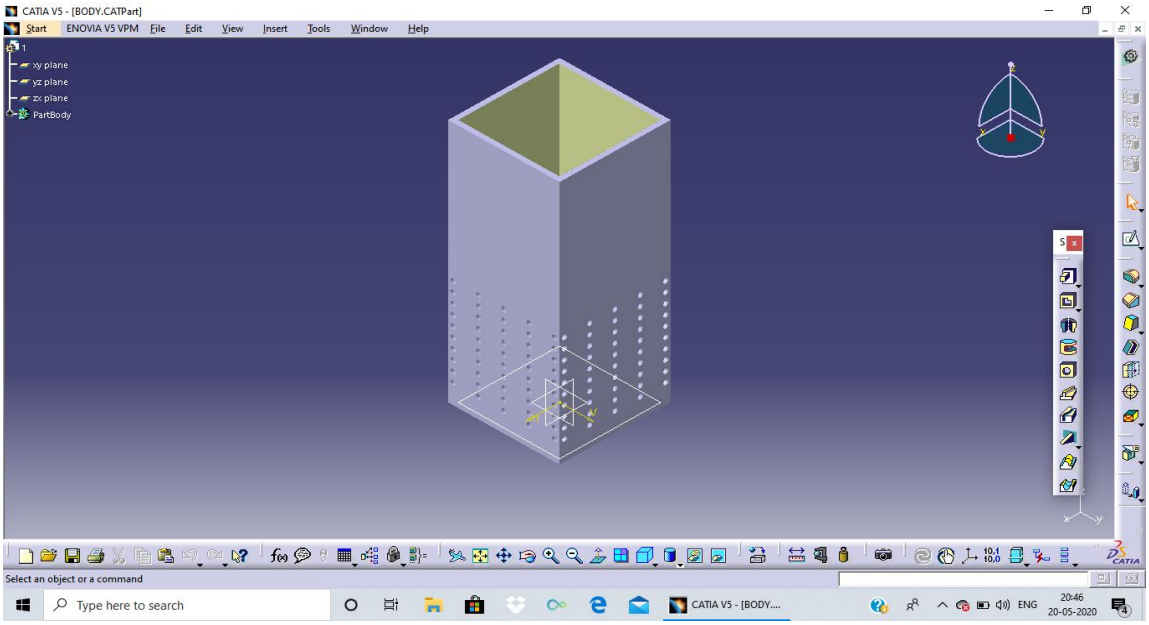

Fig.7.2 Filter Housing

6.2 ASSEMBLY OF OUTER CASING

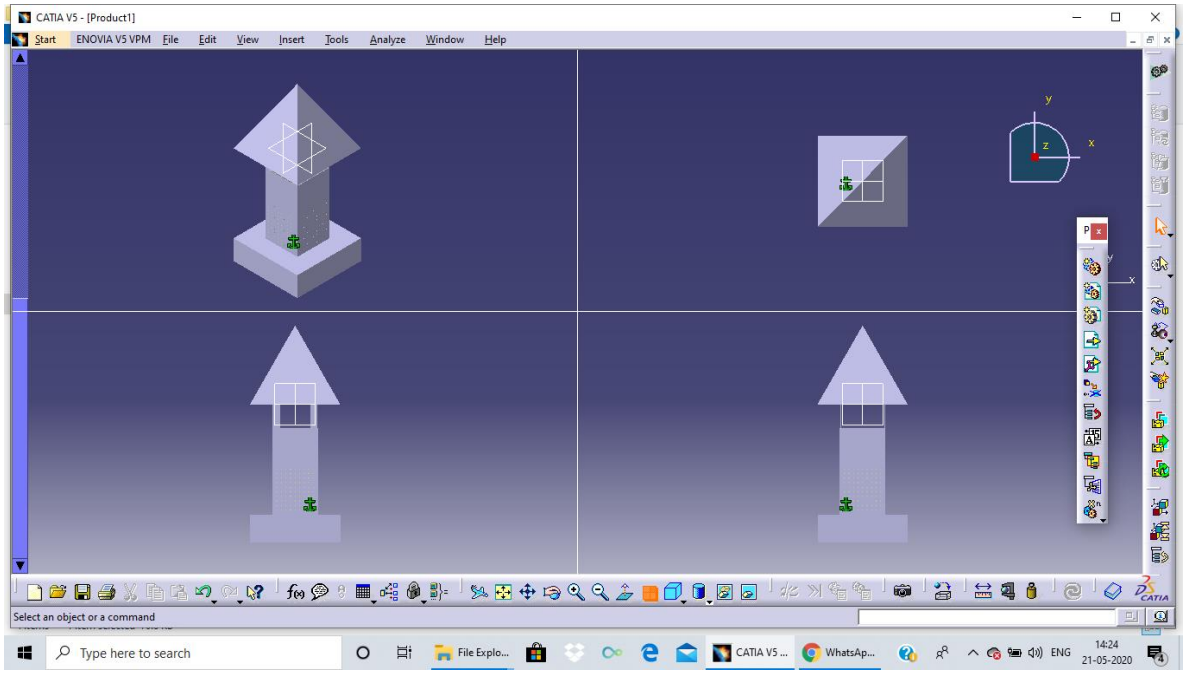

Fig. 7.3 Design of Outer Casing Assembly

CHAPTER 7

FABRICATION

- The outer casing structure was a housing made by MDF sheets. The cutting of these sheets was done in LASER printing machine.
- CAD Drawing with specific dimensions were feed to the machine to perform the cutting process.
- To provide inlet for air purifier, many holes of significant diameter was made with LASER printing machine.
- L-Clamps were used to assemble the model

Fig.8.1 Outer Housing

CHAPTER 8

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