# DES-602

**EARTH - SHOT PRIZE COURSEWORK**

**TEAM NAME :** NextGen Engineers

**TEAM MEMBERS:-**

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## PROBLEM IDENTIFICATION:-

**Issue:** Rising air pollution from urbanization, industries, and vehicles harms health and accelerates climate change.

**Urgency:** Conventional purifiers increase energy consumption, necessitating a sustainable alternative. A **solar-powered air purifier** offers a clean, energy-efficient solution to improve air quality and public health.

## LITERATURE SURVEY:-

Various air purification methods exist, ranging from mechanical filtration to electrostatic precipitation and chemical adsorption. However, most require external energy sources, increasing operational costs and carbon footprints. Solar-powered air purifiers present a promising alternative by leveraging renewable energy to drive purification processes**.**

- High-Efficiency Particulate Air (HEPA) Filters: Effective in capturing fine particulate matter (PM2.5 and PM10)
- Activated Carbon Filters: Used for VOC and gas adsorption.

- Photocatalytic Oxidation (TiO2-Based): Decomposes harmful organic pollutants under UV light.
- Smart Air Quality Sensors: Monitor and analyze pollutant levels, enabling real-time operational adjustments.

Despite advancements, challenges such as power storage, purification efficiency, and system integration remain. Addressing these issues enhances the viability of solar-powered air purifiers for large-scale urban deployment.

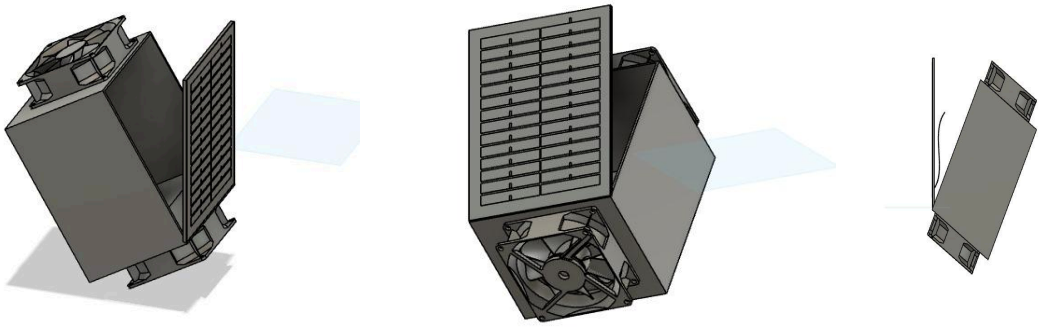
**PROPOSED DESIGN :-**

The proposed solar-powered outdoor air purifier consists of:

1. Photovoltaic Panel: Captures solar energy to power the device.
2. Air Quality Sensors (PM2.5, VOC, CO2, NOx): Detect pollutant levels in real time.
3. Filtration Unit: HEPA filter for particulate removal, Activated carbon for gas adsorption, TiO2-based photocatalysis for organic pollutant decomposition.
4. Arduino Uno Microcontroller: Controls and automates system operations.
5. Fan Mechanism: Draws in contaminated air for purification.
6. IoT Module: Enables wireless monitoring and data analysis.

WORKING PRINCIPLE :-

1. Solar panels provide energy to the purifier.
2. Sensors detect pollution levels and activate the filtration process when necessary.
3. Fans draw in air, passing it through multiple filtration stages.
4. The purified air is released back into the environment.
5. Data is transmitted to an IoT-based monitoring system for real-time analytics.



The AutoCAD design describes two mechanical fans ( one acts as inlet and the other acts as outlet), a solar panel attached to the top side of the cuboid and hollow space in between for putting HEPA filters , Arduino uno microcontroller , wires etc

**FEASIBILITY AND IMPACT :-**

PRACTICALITY

- Scalability: Can be installed in urban parks, streets, and industrial zones.
- Energy Efficiency: Operates independently of the power grid.
- Ease of Maintenance: Modular design enables easy filter replacement.

ENVIRONMENTAL AND SOCIAL BENEFITS

- Reduces exposure to harmful pollutants, improving public health.
- Promotes the use of renewable energy sources.
- Supports data-driven pollution control strategies.

ECONOMIC VIABILITY

- Initial Cost: Affordable components with mass-production potential.
- Long-Term Savings: Reduced energy consumption and health cost savings.
- Government & NGO Support: Aligns with environmental sustainability initiatives.

**CONCLUSION :-**

The proposed solar-powered outdoor air purifier offers an innovative and sustainable approach to mitigating urban air pollution.

This design not only reduces reliance on conventional energy but also contributes to a cleaner and healthier environment.

The feasibility analysis highlights the system's scalability, cost-effectiveness, and environmental benefits, making it a viable solution for urban areas.

Overall, this project demonstrates the potential of sustainable engineering solutions in addressing modern environmental challenges, paving the way for smarter, cleaner cities.