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Smart Air Purifier

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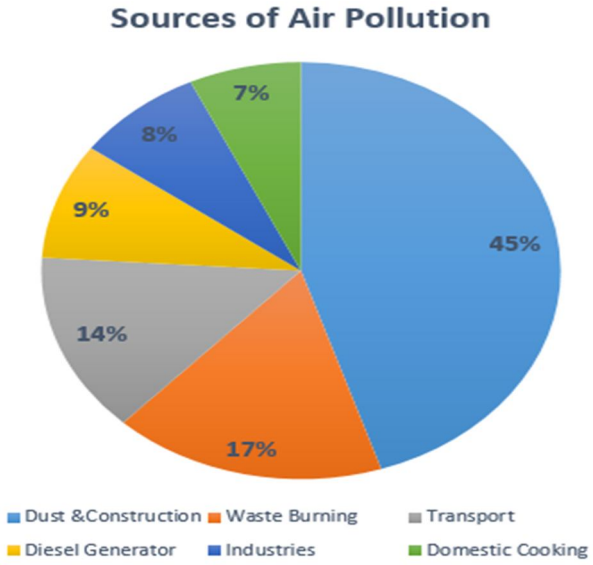
Abstract: ***The Sole purpose and vision which our project entitled to is clearly subjected to serve the health safety. Safety has been a paramount at every level, even if we talk about safety of our health. We tend to think of air pollution as something that happens outside but that's not always the case. Even inside our home, there are things like dust mites and dirt trodden in from outdoors to worry about. Indoor air pollution from sources like this can irritate your lungs and contribute to allergies and asthma. The trouble is, if you use an ordinary vacuum cleaner, you might simply be "rearranging the dirt": your cleaner will trap some of the dust inside the bag or cyclone filter but let the rest pass straight back into the room. If you suffer from asthma or another breathing difficulty, you may find a HEPA (sometimes defined as "high-efficiency particulate air," sometimes as "high-energy particulate arresting") air purifier (or a vacuum with a HEPA filter) well worth the investment.***

I. INTRODUCTION

Air pollution refers to the release of pollutants into the air that are detrimental to human health and the planet as a whole. A ir pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, pollen and mold spores may be suspended as Particles.

A. Sources of Air Pollution

Most air pollution is created by people, taking the form of emissions from factories, cars, planes, or aerosol cans. Second-hand cigarette Smoke is also considered air pollution. These man-made sources of pollution is called anthropogenic sources. Some types of air pollution, such as smoke from wildfires or ash from volcanoes occur naturally. These are called natural sources.



Air pollution is most common in large cities where emissions from many different sources are concentrated. Sometimes, mountains or tall buildings prevent air pollution from spreading out. This air pollution often appears as a cloud making the air murky. It is called smog. The word "smog" comes from combining the words "smoke" and "fog."

Large cities in poor and developing nations tend to have more air pollution than cities in developed nations. According to the World Health Organization (WHO), some of the worlds most polluted cities are Karachi, Pakistan; New Delhi, India; Beijing, China; Lima, Peru; and Cairo, Egypt. However, many developed nations also have air pollution problems. Los Angeles, California, is nicknamed Smog City.

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B. Indoor Air Pollution

Air pollution is usually thought of as smoke from large factories or exhaust from vehicles. But there are many types of indoor air pollution as well. Heating a house by burning substances such as kerosene, wood, and coal can contaminate the air inside the house. Ash and smoke make breathing difficult, and they can stick to walls, food, and clothing.

Naturally-occurring radon gas, a cancer-causing material, can also build up in homes. Radon is released through the surface of the Earth. Inexpensive systems installed by professionals can reduce radon levels. Some construction materials, including insulation, are also dangerous to people's health. In addition, ventilation, or air movement, in homes and rooms can lead to the spread of toxic mold. A single colony of mold may exist in a damp, cool place in a house, such as between walls. The mold's spores enter the air and spread throughout the house. People can become sick from breathing in the spores.

C. Effects On Humans

1) People experience a wide range of health effects from being exposed to air pollution. Effects can be broken down into short-term effects and long-term effects.

2) Short-term effects, which are temporary, include illnesses such as pneumonia or bronchitis. They also include discomfort such as irritation to the nose, throat, eyes, or skin. Air pollution can also cause headaches, dizziness, and nausea. Bad smells made by factories, garbage, or sewer systems are considered air pollution, too. These odors are less serious but still unpleasant.

3) Long-term effects of air pollution can last for years or for an entire lifetime. They can even lead to a person's death. Long-term health effects from air pollution include heart disease, lung cancer, and respiratory diseases such as emphysema. Air pollution can also cause long-term damage to people's nerves, brain, kidneys, liver, and other organs. Some Scientists suspect air pollutants cause birth defects. Nearly 2.5 million people die worldwide each year from the effects of outdoor or indoor air pollution.

4) People react differently to different types of air pollution. Young children and older adults, whose immune systems tend to be weaker, are often more sensitive to pollution. Conditions such as asthma, heart disease, and lung disease can be made worse by exposure to air pollution. The length of exposure and amount and type of pollutants are also factors.

D. Effect On Environment

Like people, animals, and plants, entire ecosystems can suffer effects from air pollution. Haze, like smog, is a visible type of air pollution that obscures shapes and colors. Hazy air pollution can even muffle sounds.

Air pollution particles eventually fall back to Earth. Air pollution can directly contaminate the surface of bodies of water and soil. This can kill crops or reduce their yield. It can kill young trees and other plants. Sulfur dioxide and nitrogen oxide particles in the air, can create acid rain when they mix with water and oxygen in the atmosphere. These air pollutants come mostly from coal-fired power plants and motor vehicles. When acid rain falls to Earth, it damages plants by changing soil composition; degrades water quality in rivers, lakes and streams; damages crops; and can cause buildings and monuments to decay.

Like humans, animals can suffer health effects from exposure to air pollution. Birth defects, diseases, and lower reproductive rates have all been attributed to air pollution.

E. Global Warming

1) Global warming is an environmental phenomenon caused by natural and anthropogenic air pollution. It refers to rising air and ocean temperatures around the world. This temperature rise is at least partially caused by an increase in the amount of greenhouse gases in the atmosphere. Greenhouse gases trap heat energy in the Earths atmosphere. (Usually, more of Earth's heat escapes into space.)

2) Carbon dioxide is a greenhouse gas that has had the biggest effect on global warming. Carbon dioxide is emitted into the atmosphere by burning fossil fuels (coal, gasoline, and natural gas). Humans have come to rely on fossil fuels to power cars and planes, heat homes, and run Factories.

3) Doing these things pollutes the air with carbon dioxide. Other greenhouse gases emitted by natural and artificial sources also include methane, nitrous oxide, and fluorinated gases. Methane is a major emission from coal plants and agricultural processes. Nitrous oxide is a common emission from industrial factories, agriculture, and the burning of fossil fuels in cars.

4) Fluorinated gases, such as hydrofluorocarbons are emitted by industry. Fluorinated gases are often used instead of gases such as chlorofluorocarbons (CFCs). CFCs have been outlawed in many places because they deplete the ozone layer.

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5) Worldwide, many countries have taken steps to reduce or limit greenhouse gas emissions to combat global warming. The Kyoto Protocol, first adopted in Kyoto, Japan, in 1997, is an agreement between 183 countries that they will work to reduce their carbon dioxide emissions. The United States has not signed that treaty.

F. Reduction

Anybody can take steps to reduce air pollution. Millions of people every day make simple changes in their lives to do this. Taking public transportation instead of driving a car, or riding a bike instead of traveling in carbon dioxide-emitting vehicles are a couple of ways to reduce air pollution. Avoiding aerosol cans, recycling yard trimmings instead of burning them, and not smoking cigarettes are others. For making indoor air more healthy for humans that's why we need air Purifiers.

II. NEED OF AIR PURIFIER

A. Why Do We Need An Air Purifier?

Air purifiers are the best way to clean your air indoors, which can be polluted and full of triggering particles like pollen and dust. They also help maintain a healthy environment by removing pet dander, mold spores, ragweed and more.

III. SPECIAL NEEDS

1) *Allergies:* If you have allergies, you should choose an air purifier designed for allergy relief. They typically have multiple filters, including HEPA filters, to remove indoor allergens.
2) *Asthma:* If you suffer from asthma or i f your symptoms are triggered by odor and chemical pollutants, you'll want to consider an asthma air purifier or an odor and chemical air purifier. These air purifiers contain added odor and chemical filtration as well as HEPA filters for allergen particle removal.
3) *Smoke:* Smoke air purifiers are specifically designed to remove smoke, fireplace soot, and other associated fumes that could aggravate existing respiratory conditions or cause unpleasant odors i n your environment.
4) *Pets:* Select air purifiers are designed specifically for handling pets--they remove pet dander, odors, and hair. View pet air purifiers here.
5) *Chemical Sensitivities:* If you are extremely sensitive to chemicals, you might consider an air purifier for multiple chemical sensitivities (MCS). These models contain even more odor and chemical filtration and are often manufactured with materials that will not off-gas chemicals into the air and aggravate your symptoms. After choosing the type of air purifier you need, consider whether or not you'd like any special features. Features include:
6) To save money and conserve energy, look for air purifiers that are Energy Star-rated by the EPA.
7) You can also find wi-fi air purifiers you can control from your phone.
8) Air quality indicators give real-time updates on the quality of your air.
9) Other features include: caster wheels, handles for easy mobility, remote controls, multiple fan speeds, and filter change indicators.

IV. COMPONENT USED

1) *Pre-Filter:* A pre-filter is a device which removes unwanted large matters from the air or water. Air pre-filters include masks and respirators. Supplied air in the workplace or transport vehicles has air pre-filters to remove dust, hair, insects, pollen, fibers, etc.. Water pre-filters remove sand, fibers and larger pollutants of drinking water.
2) *HEPA Filter:* stands for high-efficiency particulate air. A HEPA filter is a type of mechanical air filter; it works by forcing air through a fine mesh that traps harmful particles such as pollen, pet dander, dust mites, and tobacco smoke. Selecting and Using an Air Filter. You can find HEPA filters in most air purifiers.

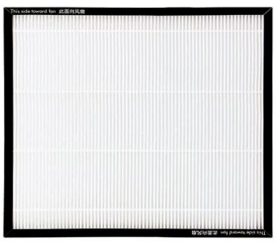

Fig: 2 HEPA Filter

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3) *Carbon Filter:* Carbon filters trap odors through a process called adsorption, which occurs when molecules attach to the outside of a surface, rather than being soaked into it (that's absorption).T he more porous the activated carbon, the better, as this will increase the amount of surface space available for contaminants to latch onto when air passes through the filter.
4) *UV-C Light:* U V air purifiers are designed to use short-wave ultraviolet light (UV-C light) to inactivate airborne pathogens and microorganisms like mold, bacteria and viruses. They have the same ultimate goal of all air purifiers: to reduce indoor air pollutants. The technology is also referred to as UV germicidal irradiation, or UVGI air purifiers. This is different from other air purifier technologies that contain UV light technology but do not use it directly against air pollutants.

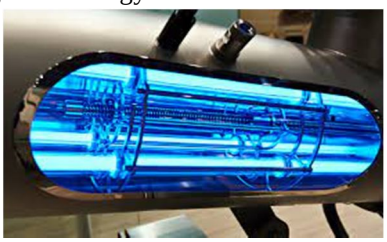

Fig: 3 U VC Light

5) FAN: The primary purpose for having an exhaust fan is to remove the moisture out of the bathroom. These fans help to control and eliminate bathroom odors. Additionally, they add to the safety of the home and its residents by reducing fumes from cleaning agents that could potentially cause health-related issues.

Fig: 4 F an

6) *MQ135 Aqi Sensor:* Gas Sensor is an air quality sensor for detecting a wide range of gases, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in an office or factory. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases.

F ig: 5 MQ135

7) *ESP 32S:* ESP32 is a series of low-cost, low-power systems on chip microcontrollers with integrated W i-Fi and dual-mode Bluetooth. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor t o the ESP8266 microcontroller.

Fig: 6 ESP 32S

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8) *Relay:* Relays are switches that open and close circuits electro mechanically or electronically. Relays control one electrical circuit b y opening and closing contacts in another circuit. When a relay contact i s Normally CLosed (NC), there is a closed contact when the relay is not energized.

Fig: 7 Relay

V. SOFTWARE USED

1) *Arduino IDE:* The Arduino Integrated Development Environment – or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the A rduino and Genuino hardware t o upload programs and communicate with them.
2) *Blynk:* Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. After downloading the B lynk app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the Screen.
3) *Google Assistant:* Google Assistant is Google's virtual helper that allows you to get stuff done faster. Instead of performing tasks manually by tapping your finger on the screen a gazillion times, you can get the job done by using voice commands. Google Assistant i s s mart and very well integrated with Android.
4) *IFTTT:* I FTTT helps you connect all of your different apps And devices. When you sign up for a free account, you can enable your apps and devices to work together to do specific things they couldn't do otherwise. Browse the IFTTT website or app To find something that interests you.

VI. BLOCK DIAGRAMS

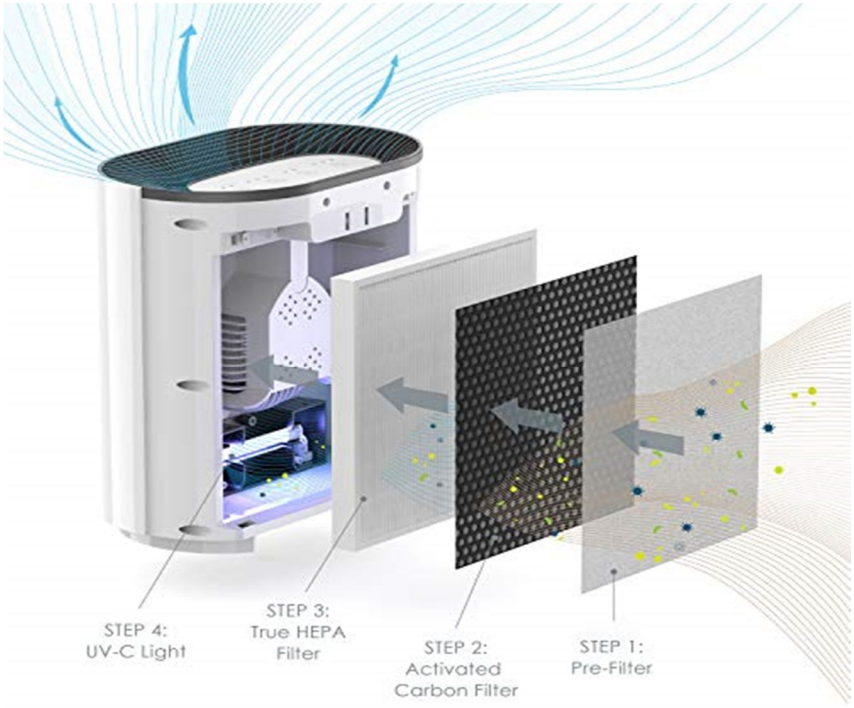

Fig: 8 This diagram shows the steps of filtration used by an air filter.

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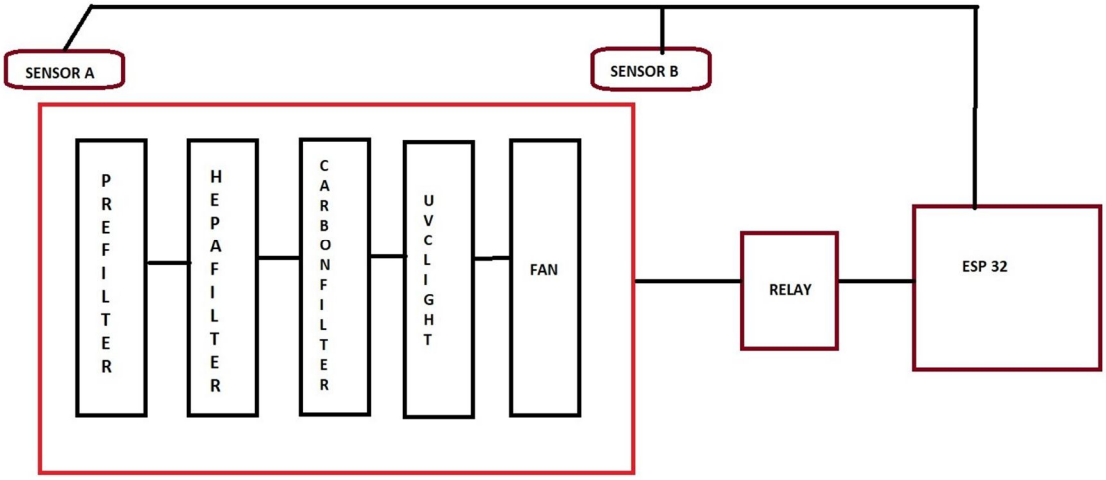

Fig: 9 Block Diagram Of Our Project

VII. APPLICATION

A. Medical

1) *Hospitals:* Use of HEPA systems in patient care rooms where either a positive or negative HEPA filtered environment is required. Typically used for infection control or isolation for communicable disease control.
2) *Clinics:* Use of HEPA systems for reduction/removal of airborne pathogens, allergens and bacteria to maintain a clean environment for outpatient procedures.
3) *Laboratories:* Use of HEPA systems in medical labs and dental labs
4) *Pharmaceutical Manufacturing:* Use of HEPA systems for containment of chemical compounds during the manufacture and development of pharmaceutical drugs.
5) *Veterinary Hospitals, Animal Kennels, and Boarding Kennels:* Use of HEPA and Carbon systems for general order reduction and isolation sick animals. Prevention of spread of disease among the animals.

B. Institutional

1) *Universities:* Use o f HEPA and Carbon systems for R&D labs for reduction/removal of airborne contaminants and/or pathogens during various phases of the research cycle.
2) *Pre-Schools and Secondary Educational Facilities:* Use of H EPA systems in pre-schools to reduce levels of airborne pathogens and minimize spread of communicable disease. Use o f HEPA systems in High Schools for overall air filtration of occupied areas.
3) *Prisons and Criminal Detention Centers:* Use of HEPA systems for reduction/removal of bacteria (TB) associated with indigent population i n these types of facilities.

C. Commercial

1) *Household Health and Personal Care Products:* Use of HEPA and Carbon based systems for reduction/removal of contaminants associated with the design and development of various chemical and compound based health care and cosmetic products.
2) *Food Products and Beverages:* Use o f HEPA systems to maintain mid-level clean room environment for packaging and processing of food grade products. This includes the bottling process for many alcoholic and non-alcoholic beverages.
3) *Retail – Restaurant:* Use o f HEPA and Carbon systems for removal of odors and airborne particulates in food service and various retail facilities. Also used for removal of cigarette and cigar smoke in those bars and restaurants that allow smoking.
4) *Apartments and Hotels:* Use of HEPA systems in apartment complex H VAC systems (where individual air handlers are used) and in high end Hotels for meeting and conference rooms.

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D. Industrial

1) *Microelectronics:* Use of HEPA and Carbon systems in the manufacture of microchips and other dust sensitive electronic components. Typically these types of products have to be fabricated in a clean-room type of environment.
2) *Optics:* Use of HEPA systems to maintain clean room environment in the manufacture of precision optics for commercial and military use.
3) *Precision Component Manufacturing:* Use of HEPA systems for reduction/removal of fine dust generated in the manufacturing of precision components to minimize maintenance issues with particulate getting into process equipment.
4) *Testing Laboratories:* Use o f HEPA systems to remove fine airborne particulate generated during various phases of compound testing (i.e. mineral labs, precious metal l abs).
5) *Automotive:* Use of HEPA systems i n the paint and coatings l abs and R&D Facilities.

E. Pharmacy and In-Store Mini Clinics

1) *Pharmacies:* Use of HEPA systems t o reduce and minimize the potential for communicable contamination from patients to Pharmacists and technicians. Positive pressure using HEPA filtered air to keep the occupied area of pharmacy clean.
2) *Mini-Clinics:* Use of HEPA systems to maintain a semi-clean room environment in the occupied areas of the clinic. Many of these clinics are now located i n retail establishments with a large growth potential for this market.

F. Military

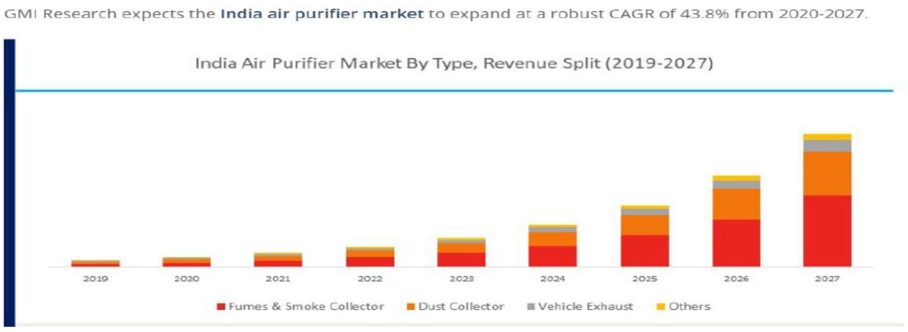
1) *Aerospace Guidance Systems:* Use of HEPA systems in the manufacture and assembly of highly sophisticated, precision guidance systems for all military aircraft, satellites and unmanned systems. These systems are always assembled in clean room environments.
2) *Chemical and Biological Systems:* Use of HEPA systems for protection of occupants in the development and testing of certain chemical and biological compounds.

G. Green

1) *LEED Certified Buildings:* Pure Air systems HEPA units are Energy Star compliant, and with the use of the ECM motors they use upto 50% less electricity than standard induction motors. The housings are all heavy gauge steel (16 to 20 gauge) designed to last the life of the application so they comply with sustainability requirements and most importantly the systems have a very low carbon footprint. These features make our HEPA systems very e co-friendly and are a n added benefit when considering the use and purchase of HEPA based systems.

VIII. FUTURE SCOPE

The India air purifier market is primarily driven b y consumer's increasing focus on health & wellness and rising awareness related to hazardous effects of air pollution on health. As the air quality keeps on deteriorating, chronic obstructive pulmonary disease becomes the second cause of deaths in India consisting of almost 1 2.5% of total deaths in 2017 and 0.48 million deaths caused by only household pollution and 0 .67 million deaths from ambient particulate matter pollution. The rise i n the adoption of air purifiers is expected to be witnessed throughout the forecast period owing to the rising pollution levels due to increasing vehicles on the road and rising industrial activities.



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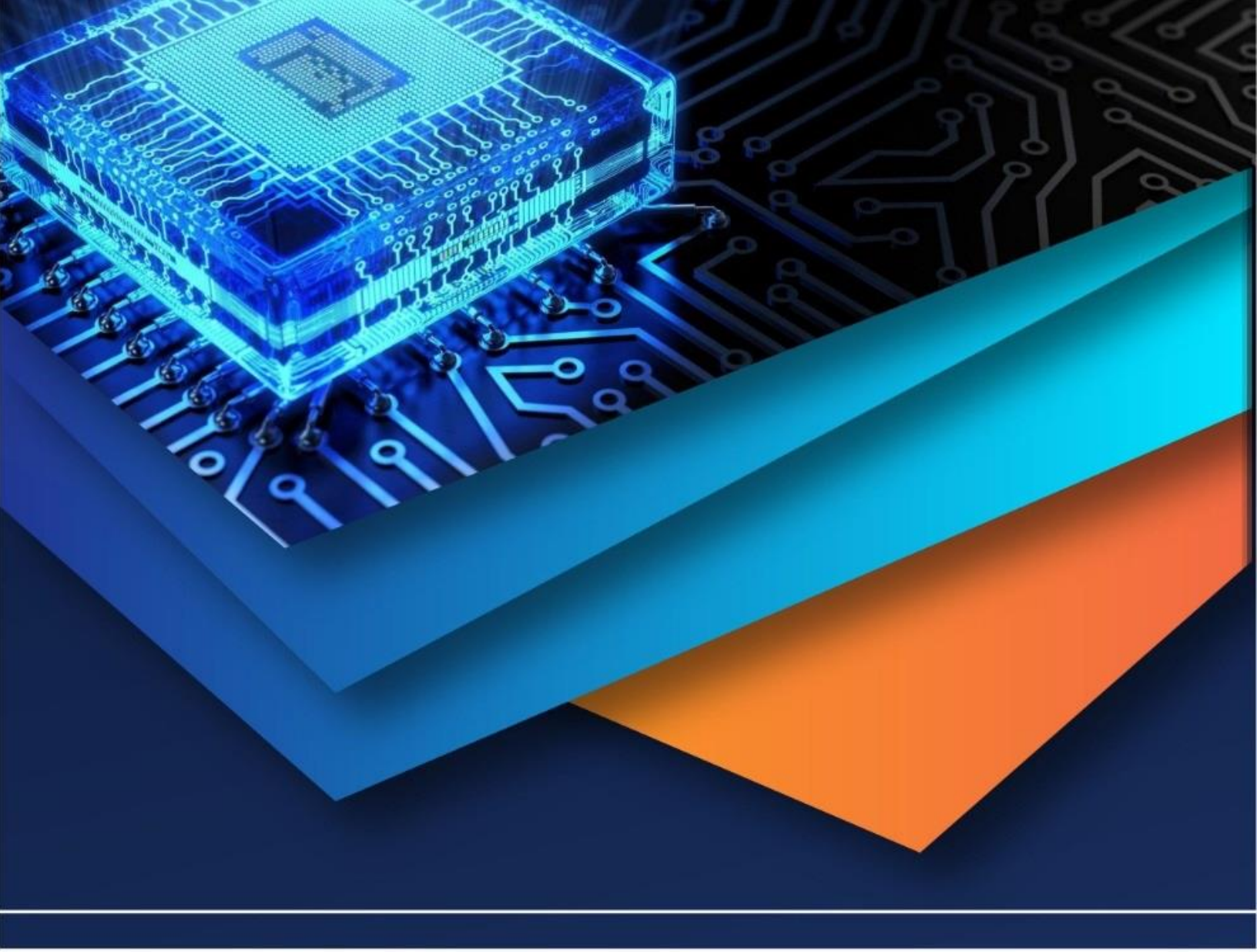

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