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# IoT Based Solar Panel Cleaning System

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**Abstract:** *Utilizing photovoltaic (PV) or compressed solar panels (CSP), solar energy converts solar radiation directly into electrical energy. Clean, green power is the most plentiful energy source on the planet. Solar energy is the power source of the future since it is renewable. These days, it is widely acknowledged worldwide. increase the energy that can be generated by sunshine. Dust accumulation on solar panels and air pollution, which lowers the energy production of solar cells by around 25% to 40% in various regions of the world, particularly tropical countries like India, are two significant barriers to achieving this aim. Given that the Indian government has set an ambitious target of building 40GW of solar power, it is also our responsibility to support this aim.*

*.The Indian government has set an ambitious target to develop 175GW of renewable energy capacity over the next five years, which includes grid-connected rooftop solar photovoltaic installations by 2022. This research proposal focuses on the use of Internet of Things (IoT) technologies to construct a smart solar panel cleaning system. The total efficiency of solar PV panels is enhanced by its capacity to detect dust, conduct advanced analysis, and maintain system management.*

**Keywords:** Utilizing photovoltaic

## I. INTRODUCTION

The modern world is growing more and more in need of sustainable energy options. The application of sunlight for power generating as a sustainable means of energy is growing

Solar PV cells, glass, and output collectors make up solar panels, which are essential components in the process converting sunlight to industrial electricity .In order to attain a high level of generation efficiency, solar panel dust buildup and warmth must be regulated. Solar panels be made more efficient by a range of methods

such as water splitting to regulate temperature and high-pressure steam, gear, or bearing systems to reduce dust. In this project, we suggest a mechanical washing system solar panels that makes use of an electromechanical shaft to remove dust .this project provides an eco- friendly way to generate electricity. With its abundance and lack of cost, solar energy has a great deal of potential for conversion into electrical energy. An solar monitoring apparatus is incorporated into the project that With The objective of capturing all available solar energy

this initiative aims to maximize use maintain its financial sustainability. This automatic solar tracking provides hope polluted environment by using solar energy to produce a sustainable and endless energy source.

## II. LITERATURE SURVEY

Henri Becquerek made the discovery that light may be converted directly into electricity back in 1839. Then, in 1905, Albert Einstein used quantum theory photovoltaic principle Numerous studies have examined dust and other contaminants on solar panels, and have been conducted to address these issues. A few hypotheses and studies are listed. [1]

The two primary aspects that must be considered To be able to maximize the effectiveness of solar cells are the volume of sunlight that directly reaches how much of this electromagnetic energy of light there is that may become accustomed to create electricity. One issue with solar energy systems is the particulate matter that collects on them when in use. Dust collection on the solar power cells reduces their performance greatly particularly in Saudi Arabia regular sand and dust storms occur.[2]

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The main factor affects a solar panel's efficiency is dust, which can reduce its efficiency by up to 50%, depending regarding the surroundings. The solar PV modules are generally employed in dusty environments which is the case in tropical countries like India. An automated system will be implemented to ensure optimal functioning of the solar panels by routinely cleaning them. Utilizing appropriate manufacturing and controllers will enable this project to be completed.[3]

Ronak Asodiya. Non-renewable energy is becoming more and more limited in our planet Around 60– 70% of the world's energy comes from fuelwood and agricultural waste. The world is away from non-renewable ones due to economic and environmental concerns.[4]

Rao, Neha, S. Santosh Kumar This proposed paper outlines the installation for a clever technique for cleansing solar energy systems, with to enable advanced analysis, dust monitoring, and system control, all of which lead to an improvement in the total effectiveness of the sun's energy solar panel.[5]

## III. EXISTING SYSTEM

It ensures that and automate the cleaning process, sensors, actuators, and a communication network must be included into The digital Internet of Devices' architecture-based Solar cell scrubbing apparatus Sensors for solar panels: Mount sensors on variables such as electricity output, temperature, tilt angle, and dirt accumulation. Communication Module: Acting as the central nervous system, this device interfaces with the cleaning mechanism. Data Processing and Analysis: Put algorithms into information gathered by sensors. Assess each panel's degree of cleanliness, then plan its cleaning according to predetermined cutoff points or prediction models. Cleaning Mechanism: To carry out the cleaning procedure, integrate actuators such as robotic arms or nozzles that are motor- controlled. When necessary, the mechanism can be set to travel along the rows of panels and spray cleaning solution or water.

## IV. PROPOSED SYSTEM

Install sensors on each Solar power panels for keep an eye on things like power output, temperature, tilt angle, and dirt collection. The data gathered by the sensors should be received, stored, and processed using a cloud-based platform. Algorithm for Decision- Making: this examine sensor data to determine the ideal timetable for cleansing In the procedure for making decisions, variables including weather, energy production, and cleansing historical data should be taken. Actuation System: Using the algorithm's judgments, put in place an actuation system to automate the cleaning procedure.

## V. IMPLEMENTATION

Considering the ESP8266 microcontroller, the Node MCU is a well-known development board, as demonstrated in Figure 5.1. It is perfect for The Web of Things applications because it has built-in WiFi connectivity. The board is compact in size and has GPIO pins to connect several actuators and sensors

An electronic circuit or module that regulates the direction and motion of motors is called a motor driver. A motor driver may be employed to control the DC motors in solar panel cleaning robot, which are in charge of the robot's movement and cleaning processes. Typically, motor drivers receive input signals from a microcontroller and supply the power and control signals required to run the motors

DC motors is employable for locomotion solar panel cleaning robot, enabling the robot to move throughout each panel's top. To function, DC motors need a power source and the right control signals from a motor driver.

The NodeMCU, sensors, driver of a motorized vehicle, and DC motors should all be able to operate at stable, sufficient Current in addition to voltage levels, which ought to be provided by the power supply. To guarantee that the entire system operates dependably, it is imperative to confirm that the power source is capable of providing the necessary power.

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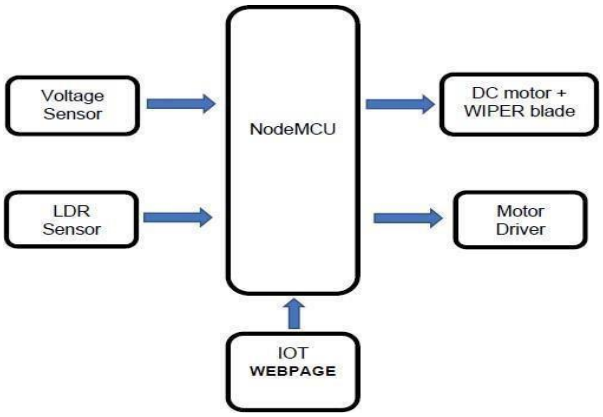
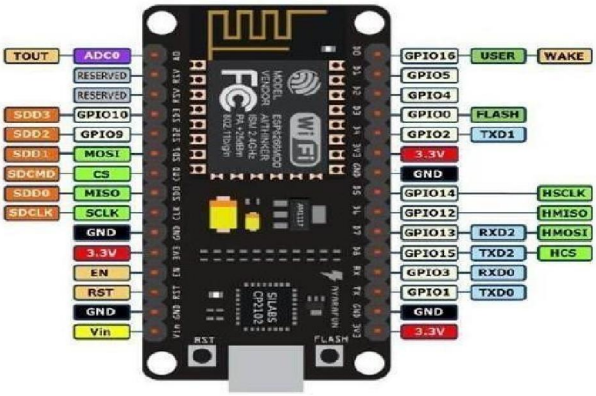
## VI. METHODOLOGY

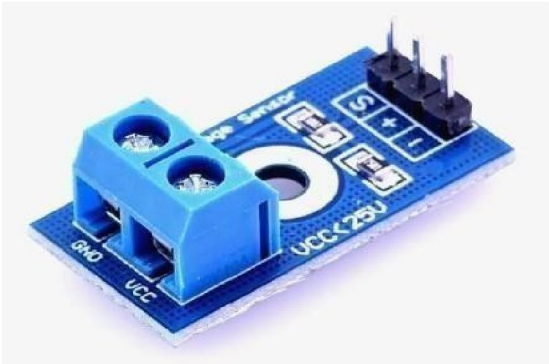



## VII. RESULTS

**NODEMCU**




**VOLTAGE SENSOR**



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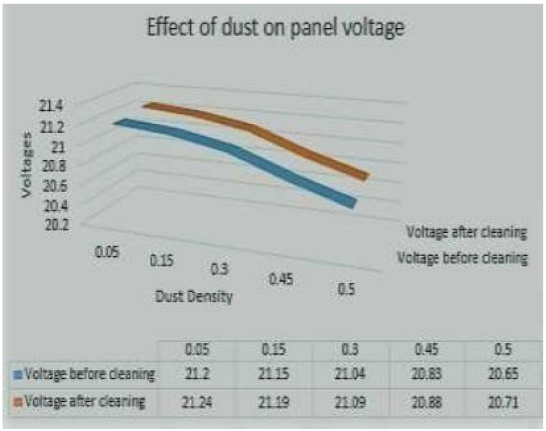
**Comparison of solar panel volatges before and after cleaning**

| SL No. | Dust Density | Voltage (V) Before cleaning | Voltage (V) After cleaning |
|---|---|---|---|
| 1 | 0.05 | 21.2 | 21.24 |
| 2 | 0.15 | 21.15 | 21.19 |
| 3 | 0.30 | 21.04 | 21.09 |
| 4 | 0.45 | 20.83 | 20.88 |
| 5 | 0.50 | 20.65 | 20.71 |

**Graph analysing the panel voltage**




## VIII. CONCLUSION

As seen in Figures, a substantial buildup dirt on the sun panels can drastically lower the voltage that is detected by the panels. By eliminating the majority of the settled dust, cleaning the solar module with water can significantly increase the panels performance and efficiency. The project's results show that the measured output voltage reduction can be anywhere between 5% and 10%. By efficiently analyzing system metrics, Things-based Solar power panels washing mechanism helps users make more educated decisions and eventually boosts system efficiency.

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