

# Fabrication of Automatic Solar Panel Cleaning System without Water

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## ABSTRACT:-

Solar energy, which is one of the renewable energy sources, has an important role in meeting the increasing electrical energy demand of our globe. In recent years, many countries have established their energy policies based on solar energy, and researchers have been working on solar panel efficiency, maximum energy extracted from the sun is converted into electrical energy via solar panels. To extract continuously maximum energy level from the sun reduces installation costs and makes it easier to meet the demanded peak electrical power.

Solar power is mainly harnessed from photovoltaic (PV) panels which are arranged in multiple arrays in a solar farm or solar system. However, the efficiency of energy generated from PV panels is affected by the accumulation of dust and debris, even on one panel in an array. This condition leads to the need for regular cleaning of the surface of the PV panels. Current labour-based cleaning methods for photovoltaic arrays are costly in time, water, and energy usage as well as lacking in automation capabilities.

To overcome this problem, a fully automatic solar panel cleaning system without water is proposed. The design utilizes an Arduino controller system to control the movement of the robot during the cleaning process.

## I. INTRODUCTION

In recent years, photovoltaic technology has advanced fast for power generation from sunlight. Cleaning methods for solar panels are researched in order to keep solar panel efficient. There are two types of cleaning system available manual and automatic cleaning systems. There is a risk of damaging AR coating of solar panels by manual cleaning and it is a tedious process.

Therefore, we need to develop automatic solar panel cleaning system, which does not damage solar panel.

Water based cleaning system is expensive, incurs recurring cost, eco-unfriendly. Water based cleaning system leaves residues and causes scratches due to scrubbing of panels. We have used microfiber technology that effectively removes moisture and dust particles without scratching it. It is washable and re-useable. These merits make this type of cleaning system competitive in many applications than conventional manual cleaning system. In this paper, I have proposed, microfiber based automatic solar panel cleaning system.

The two DC motors are mounted on two sides of solar panel in anti-parallel connection and excited at the same voltage. Motors are connected with the help of track wheels. Aluminium strip with microfiber is connected between two sides of solar panel with the help of track belts. Speed of motor is controlled by program which is set in the Arduino UNO.

## II. REVIEW OF LITERATURE

V. Bhubaneswar et al. (2014) described The Internet of Things (Iota) is the most promising area which penetrates the advantages of Wireless Sensor and Actuator Networks (WSAN) and Pervasive Computing domains. Different applications of IoT have been developed and researchers of IoT well identified the opportunities, problems, challenges and the technology standards used in IoT such as Radiofrequency Identification (RFID) tags, sensors, actuators, mobile phones, etc. This paper is of two fold; the first fold covers the different applications that adopted smart technologies so far. The second fold of this paper

presents the overview of the sensors and its standards. KelebaoneTsamaase et al.

(2017) presented the development of an automated dust detection and cleaning system which could be used to clean photovoltaic (PV) modules. Dust accumulation is one of the factors which negatively impact of the PV module output because it obstructs solar radiation to incident on the module surface hence reducing the overall performance of the system. The system was designed by writing a C program and compiled with Arduino IDE to read voltage and sense current from the PV and calculate power output. The circuit was built with proteus 8 professional. Simulation results show that the system was able to detector power loss due to dust accumulation on module surface and as a results the motor drive for the cleaning mechanism responded accordingly to operate cleaning mechanism. The work is still ongoing whereby a prototype will be built to demonstrate the practicality of the system. Swanand S. Wable et al.

(2017) proposed the Solar Panels Farms are generally situated in dirt and dust areas which are mostly in case of tropical countries. The performance of solar panels depends on various factors, the power generated by farm can decreased if there is dust and dirt on panels and this is the main factor for reduction. One can generally assume a reduction of about 40% - 50%, if the panels are not clean properly for 1-2 months. So to overcome this problem and to increase the efficiency of power production cleaning of module on regular basis is necessary. To clean the dust, an automatic cleaning robot is developed, which will clean the panels on regular interval of time. The mechanism is based on control circuit, DC motor; microfiber (bristles) to clean the panels. The paper provides you with the idea how the robot will work and its effect on the energy production by solar farms. It will also to help to understand the problem arise due to not cleaning of solar cells. Manju B. et al.

(2018) described energy is one of the major issues that the world is facing in India, the supply of energy has been one of the major problems for both urban and rural households. About 60% to 70% of the energy demand of the country is met by fuel wood and agriculture residues. Solar energy is a renewable source of energy, which has a great potential and it is radiated by the sun. Renewable energy is important to replace the using of electric energy generated by petroleum. Solar power has become a source of

renewable energy and solar energy application should be enhanced.

The solar PV modules are generally employed in dusty environments which are the case tropical countries like India. The dust gets accumulated on the front surface of the module and blocks the incident light from the sun. It reduces the power generation capacity of the module. The power output reduces as much as by 50% if the module is not cleaned for a month. The cleaning system has been designed cleans the module by controlling the Arduino programming. To remove the dust in the PV modules to improving the power efficiency. Subhasri.G et al. (2018) presented a sunlight based framework is the device for orienting solar photovoltaic modules and solar thermal collectors toward the sun.

### III. PROBLEM STATEMENT

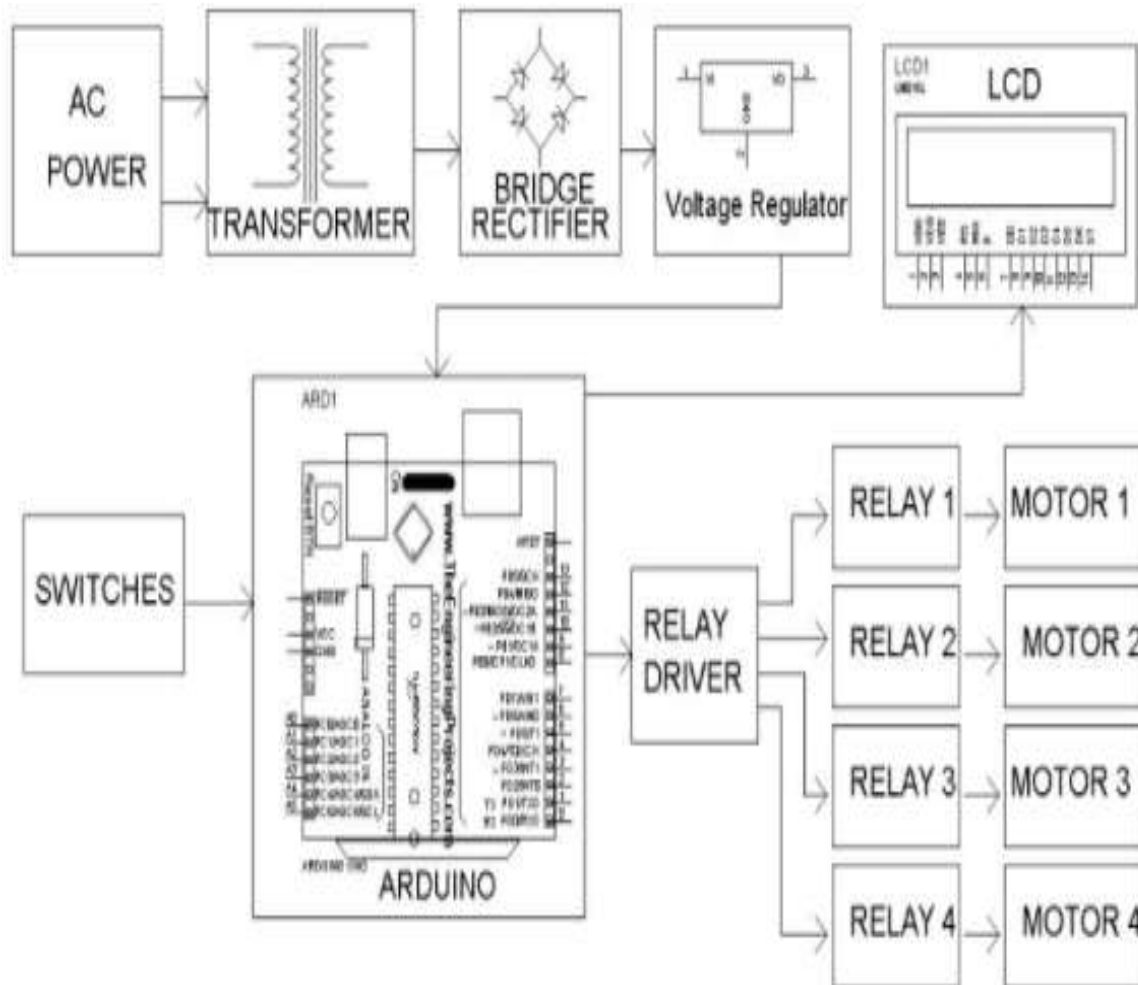
Solar panel absorbs the sunlight as the source of energy and then it is converted into the electricity or heating purpose. A photovoltaic module of the solar panel contains the about 6\*10 photovoltaic cell. This photovoltaic module represents the electrical phenomenon array of electrical phenomenon system that generates the electricity for various purpose of use. The Automatic Solar Panel Cleaning System is an advanced system used to clean the solar panels automatically in industrial area as well as it is used for the residential purpose too. The sensor embedded in the system is used to measure the various input from the environment and the work according to it. Thus system is useful for cleaning the solar panels which are beyond the reach for humans for cleaning purpose as well as where there is a threat for a human being then this system can be used. The main and prime agenda for developing this system is there are lots of people who cannot buy the automatic cleaning system just because they are pretty costly and thus they tends to go out for reaching to the solar panels and clean them. This act might prove to be life taking and thus they can be safe via using this product

### IV. OBJECTIVE

This paper about the Fabrication of Automatic Solar Panel Cleaning System Without Water. The main object of this design prototype is to clean the solar panel using an electrical mechanism, such that efficiency or quality of solar panel is not compromised. As a matter of fact, gulf region - especially Saudi Arabia- are facing a lot of dust storms and the solar panels need to be cleaned frequently. If task is performed manually, it will be very costly and time consuming.

## V. SYSTEM DESIGN

### BLOCK DIAGRAM



### HARDWARE REQUIREMENTS

- Transformer
- Rectifier
- Regulator
- Arduino UNO
- Switches
- LCD
- Relay
- Relay Driver

### SOFTWARE REQUIREMENTS

- Arduino IDE
- Proteus
- Eagle

### ARDUINO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board

(often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the microcontroller into a more accessible pack

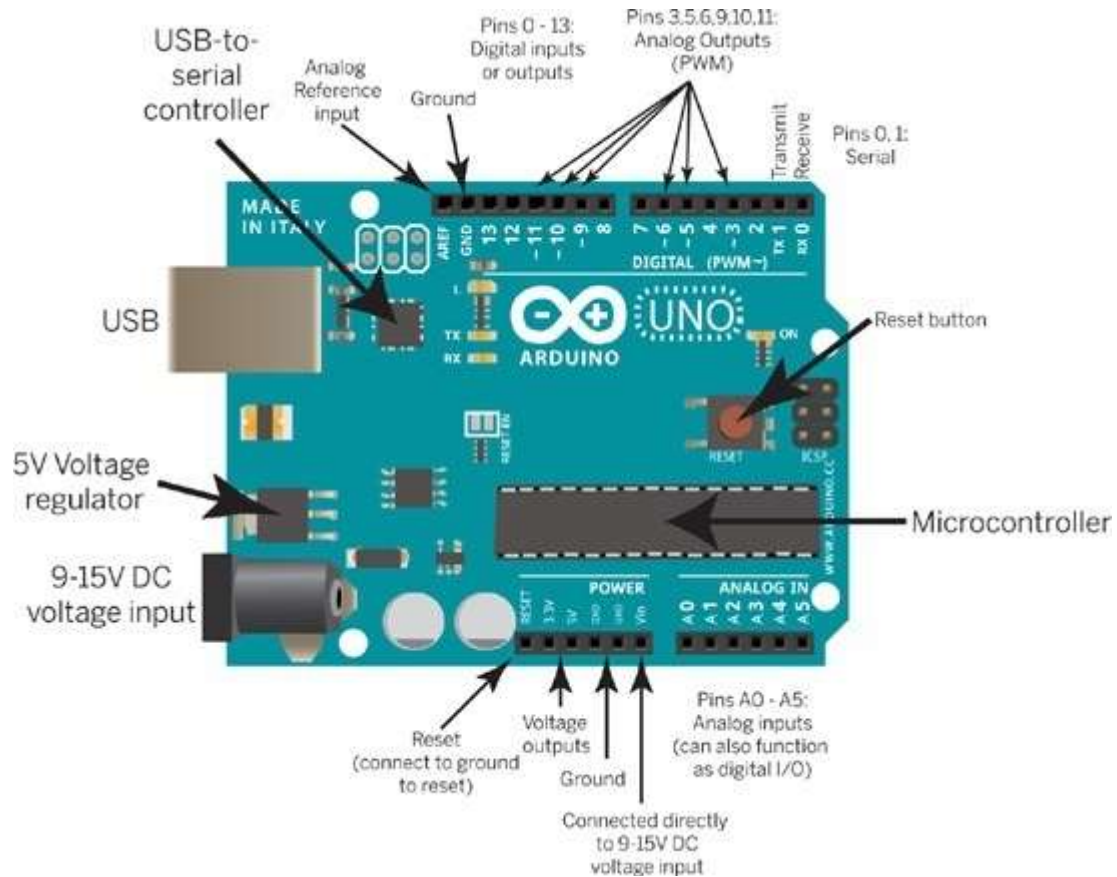


Fig: Arduino board

The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. We'll talk about what's on it and what it can do later in the tutorial.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in

electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

#### Arduino Pin Diagram

A typical example of Arduino board is Arduino Uno. It consists of ATmega328- a 28 pin microcontroller.

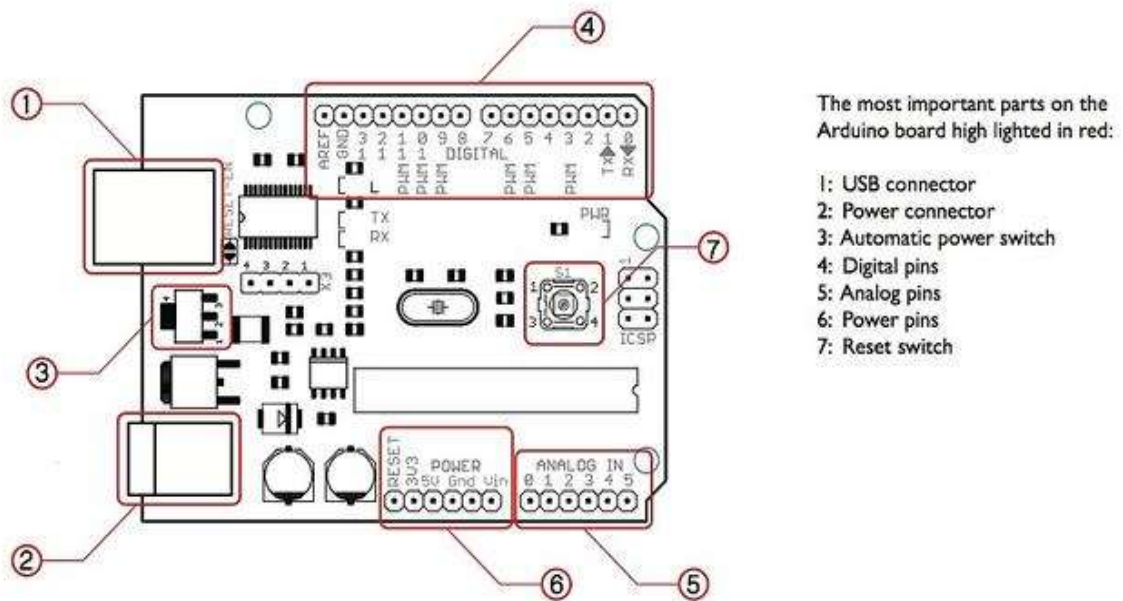


Fig: Arduino pin board

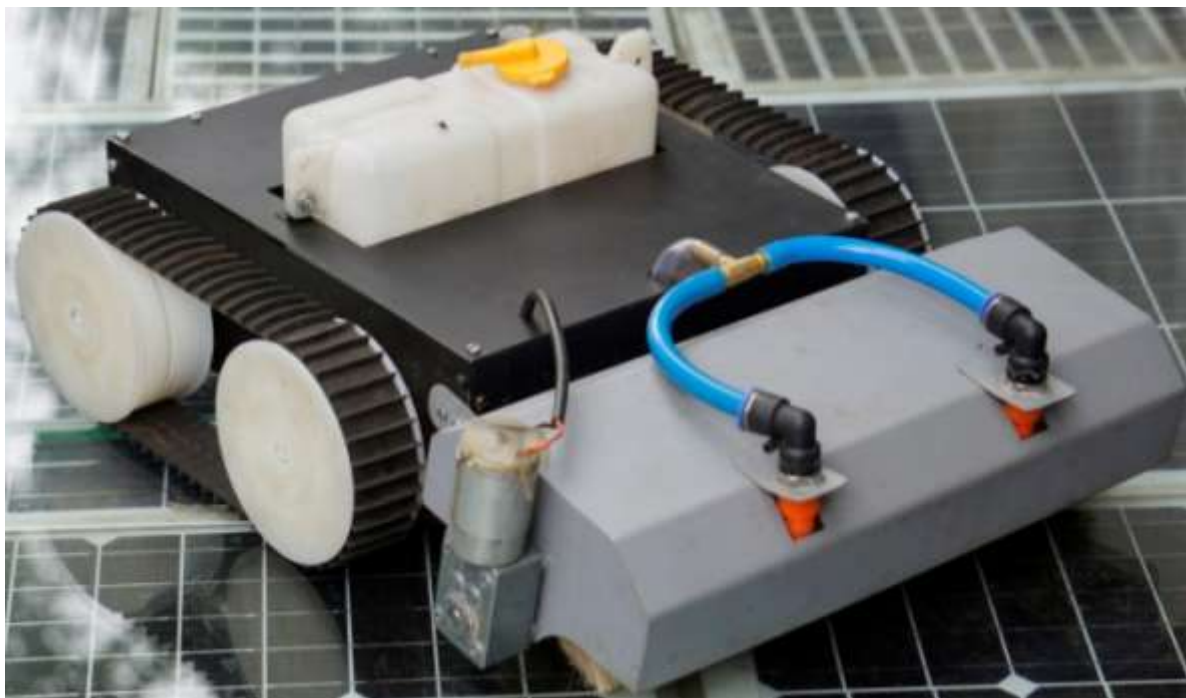


Fig: Prototype model automatic Solar Panel Cleaning System Without Water

## VI. CONCLUSION

The Fabrication of Automatic Solar Panel Cleaning System Without Water is aimed to bring a better solution for maintaining solar efficiency. The main scope was to develop a machine that can clean a solar panel with a proper control system. This work is a developed prototype to expand on a new and increasing market.

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